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### On the cover

For three decades, the fabled Chevy Corvette has been America's one and only true sports car, inspiring a cult of admirers whose loyalty borders on fanaticism. PM recalls the great vintage Vettes and drives the sleek, new '83 model—clearly the best one yet—in the story that begins on page 84.

—PM photo by Peter Tenzer

# Popular Mechanics®

MARCH 1983

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- (A) Little or no experience
- (B) Some experience
- (C) Quite a bit of experience

**2** Which phrase best describes your workshop?

- (A) A selection of hand and portable power tools
- (B) A table or radial arm saw, hand and portable power tools
- (C) A good selection of stationary and portable power tools

**3** How involved do you want to become with woodworking, home repair and maintenance?

- (A) Not very involved
- (B) Moderately involved
- (C) Heavily involved

**4** What's the likelihood that you'll buy a woodworking tool within the next year?

- (A) Not likely
- (B) Somewhat likely
- (C) Highly likely

**5** Which best describes you?

- (A) I do some home repairs and maintenance
- (B) I do some woodworking and a variety of home repairs
- (C) I'm primarily interested in fine craftsmanship woodworking

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# EDITOR'S NOTES

John A. Lillington

**"Striking . . . sleek . . . comfortable . . . handles nicely . . . but the performance doesn't match its pedigree."** That, in a cover line, was Stirling Moss's assessment of the new De Lorean Sports Car back in June



June '81: De Lorean and Stirling.

1981 when we ran it on our cover. Then in May 1982, we printed a PM Owners Report on the car. Most owners had purchased the stainless-steel auto on the basis of styling. But nearly 18 percent also felt it was a good investment. So far, it appears that the investment-minded will wind up disappointed. The De Lorean has joined other legendary grand failures of the auto world. Mike Lamm tells about them—some will surprise you!—in a story that begins on page 79.

**The United States is not enthusiastic** about cooperating with the Soviets when it comes to things like pipelines. But Americans and Russians are working together in a venture that produces the fish sticks you have in your freezer. Word of the joint fishing venture came as a surprise to us. If you're surprised, too, you can read more about it in John Burnett's article on page 88.

**The weather in southern California is always great.** Right? That's what the Chevrolet public relations people figured when they scheduled the press preview of the new Corvette last year in early December. But this time they figured wrong. The heaviest storm in 20 years hit Riverside International Raceway the night before the debut. It blew down a giant tent, destroyed dozens of displays—and left a coat of mud on several areas of the track. The introduction and driving went on as scheduled. But the event took on the look of a car washer's convention as drivers and camera teams shined up Corvettes between runs. We got pictures of the new Vettes, clean and shiny, courtesy of our car washing and driving experts Tony Assenza and Joel Breault. **PM**

*The storm is over, but the mud remains. Here, Joel Breault and Auto Editor Tony Assenza use window cleaner to put a shine back on their '83 Corvette.*



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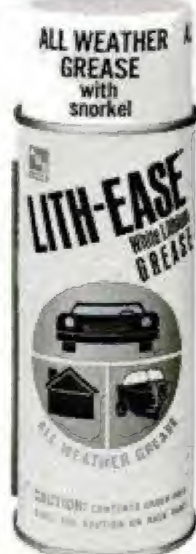


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# LETTERS TO THE EDITOR



## Old warbirds live on—but not many

I read with great interest Budd Davisson's article on restoring old World War II warplanes (*New Wings For Old Warbirds*, page 80, Dec. '82). He mentioned the P-47 Thunderbolt and how so few of them are still flying today. I was stationed at Drew Field, Fla., for four years during WWII and talked to many pilots returning from combat overseas. They had nothing but praise for the rugged P-47.

There would undoubtedly be even fewer still around today if it were not for their remarkable ability to return home even when riddled with bullets and flak. The P-47 was a truly awesome fighting machine.

GARDNER F. SMITH  
DANVERS, MASS.

Talk about the terribly wasteful destruction of WWII aircraft! The RAF used rows of Spitfires as strafing targets in the 1950s, and I've bombed Messerschmitt 109s that were used for target practice in Germany.

The P-51 Mustang was a fine fighter, as you say, but I'm pretty sure they all had Packard engines, not the Rolls-

Royce Merlin that you mentioned in your article.

W. J. McWILLIAMS, MAJOR, USAF  
MOOSE JAW, SASK.

It was a great story, but your listing of famous air museums left out the fine one we have here in Tucson. It has many historic fighters and bombers of WWII. The area was a major flight training center during the war, and many abandoned airfields can be found, along with old wrecks.

CHARLES G. GRIFFITH  
TUCSON, ARIZ.

*Our listing of air museums was intended primarily to cover those noted for having WWII aircraft in flying condition, where you can actually see them performing in the air. There are many fine museums offering static displays that we were unable to mention because of limited space.*

*Regarding the P-51 Mustang, several types of engines—Allisons, Packards and Rolls-Royce Merlins—were used in different models. The P-51 our author flew had the Rolls-Royce Merlin.*

## In defense of defense

In your December '82 *Letters* column (page 6), one of your readers criticized you for your coverage of military equipment. He said he wants to see only "peaceful things" in PM.

I'm glad we have battleships, bombers, tanks and, yes, even nuclear weapons. We need a strong defense to prevent war, so we can have "peaceful things." Keep up the good work.

J. E. GUY, M.D.  
FORT LAUDERDALE, FLA.

Doesn't he realize that he is free to voice his opinions in public only because America has a strong military to protect his rights? Let him go live somewhere else and see how much freedom he has then!

RUSSELL W. HOLDER, M.SGT., USAF (RET.)  
CARROLLTON, TEX.

## Turbocharging update

I must compliment you on Don Fuller's article on turbocharging (*Turbocharging: This Time It's Here To Stay!*, page 71, Dec. '82). It was a very complete and enlightening report on a system that we at Saab are happy to have helped launch.

I should, however, point out a few errors in statements regarding Saab. The boost pressure for the Saab Turbo was reported as 8.7 p.s.i. For the 1983 Saab Turbo, this figure is 9.5 p.s.i. Also, the EPA mileage (city) is 21, not 20 as reported.

Your price comparison was based on 1982 prices and was somewhat misleading since the Turbo price includes a very expensive sound system and electric side mirrors, items not included in the normally aspirated Saab 900S. The actual prices for 1983-model Saabs are \$13,550 for the 900S and \$16,510 for the Saab Turbo.

LENNART LONNEGREN  
SAAB-SCANIA OF AMERICA INC.  
ORANGE, CONN.

Author Don Fuller replies: We regret that some of the differences between the 1982 and 1983 Saab models were not noted in our article because it was necessary to go to press before the latter figures could be confirmed. Thanks for the update.

PM

## Yes, we have 'em

For years I've been searching for plans on making wooden clockworks. I've seen kits, but they wouldn't be as much fun as constructing a works from scratch. Can you help me?

WALLACE W. NELSON  
GRAND FORKS, N.D.

You came to the right place. We ran two articles on making wooden clockworks, one early American and one Swiss. Photocopies are available from *Popular Mechanics*, Box 1014, Radio City Station, New York, N.Y. 10101. Ask for No. X178 (early American, \$6.50) or No. X179 (Swiss, \$2.50).

## PM's 3-in-1 pedal car

Here is a picture (right) of the PM pedal car that appeared in your August '82 issue (*Build PM's Delivery Wagon*, page 62). We built the dump truck version. The plans were excellent, and the

car is a solid design that should last for many years.

PHILLIP D. MATHER  
NILES, MICH.

Thanks for the great photo. For others who may be interested, plans for the car—a roadster, dump truck or delivery van—are \$9.95 postpaid from Stevenson Projects, Box 584, Del Mar, Calif. 92014.



Happy youngsters enjoy PM's convertible pedal car, built by reader Mather.



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Like a fine watch, a Mariner Outboard demonstrates an ingenious use of space. Every part that's not absolutely essential has been eliminated. This not only makes the motors more compact and exceptionally lightweight for the horsepower they deliver, but it also helps reduce maintenance.

And, if you could look inside each one, you'd see an attention to detail seldom found in an object too large to strap to your wrist. For example, CD ignition eliminates the

need for troublesome breaker points. Most models feature thru-prop exhaust for more speed and more efficiency. They're quieter, too.

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# IMPORTS & MOTORSPORTS



## Measuring a Mercedes

Some old, simple formulas have long been dead: like cars costing a dollar a pound. Others—like buying the biggest and heaviest car for your money to

be assured of getting a car with great ride and feel—die a little harder.

The way a car feels no longer has anything to do with dimensions and weight (as any Renault Le Car driver will be glad to demonstrate by barreling over a railroad crossing).



*Trunk volume of compact Mercedes benefits from aerodynamic wedge shape.*

That's why a luxury carmaker like Mercedes-Benz can field a compact car that still feels like a Mercedes. That feel may be too taut for Lincoln Continental owners, but it won't disappoint anyone who has enjoyed driving the larger M-B models.

The smallest Mercedes is a stunning-



*Smallest Mercedes-Benz will go on sale in fall as '84 model.*

looking little car that's already available in Europe, wearing a 190 or 190E badge (two-liter, gasoline Four, carbureted or fuel-injected).

When the car joins the line here in the fall, though, it will be a 220E and be powered by the Mercedes 2.3-liter, fuel-injected gas Four. A 220D with diesel power will follow.

The 220E/220D could knock the 240D out of the lineup if buyers flock to the new car, which will fall right into the 240D price niche: \$24,000.

The 220E/220D is built on a 105-in. wheelbase, is 174 in. overall and weighs plus or minus 2,400 pounds depending on engine, transmission and options. Unlike the larger M-B models (except the 240D), the new car will offer four- and five-speed manuals in addition to an automatic transmission. (The automatic has an economy mode which sets the transmission to start from a stop in second gear and make upshifts at lower speeds.)

For now that's the dimensions and weight story, but next month we'll describe that Mercedes feel which we experienced driving the 190/190E in Europe.

## Four-door Ferrari

The most exciting and fastest Ferraris have no doors: They're the bright red Formula One racers, of course. Enzo Ferrari's street cars, also pretty quick, have all been equipped, up until now, with two doors. The first four-door, or *quattroporte*, Ferrari, which will debut



*Ferrari sedan, a Pininfarina design, is the first four-door from the automaker.*

this year, is expected to be the fastest four-door production sedan: 160 mph. The 5.0-liter, flat Twelve "Boxer" engine, the same as used in the BB 512i, will be the powerplant and the transmission will be automatic. It'll be a limited-production sedan, naturally, with only one copy coming out of Ferrari's shop door in Italy each working day.

## Audi station wagon

While we wait for spring and Audi's replacement for the 5000, already being sold in Europe as the Audi 100, the German car company is considering producing a station wagon model to



*Audi Avant is wagon version of the 100.*

join its very aerodynamic four-door sedan.

The Avant, as the wagon design is being called, has a swoopy new tail end to squeeze in a small, forward-facing jump seat behind the conventional rear bench.

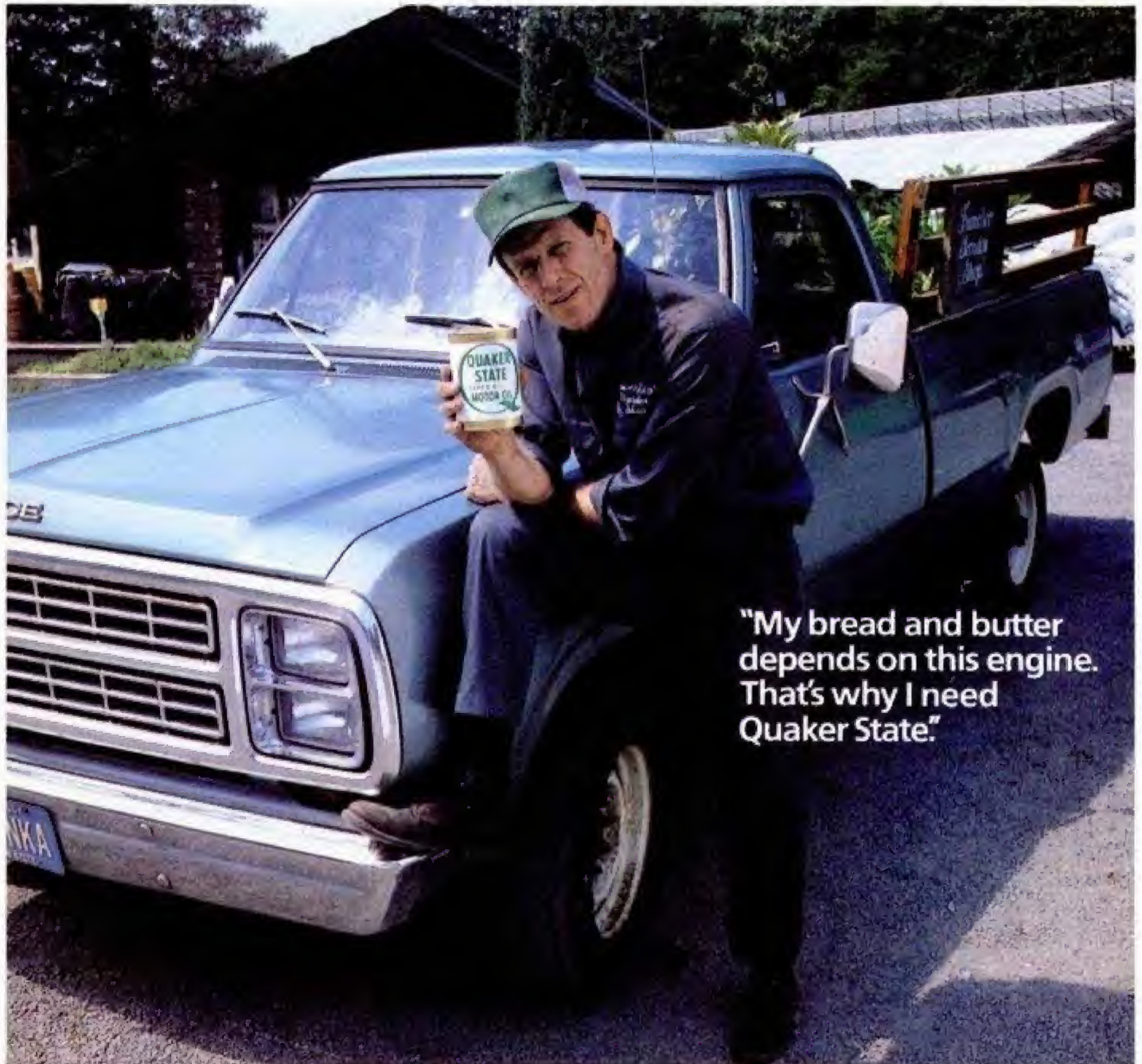
**PM**



*Instruments and controls are perfectly placed, right down to the glovebox latch, which is asymmetrically located in order to be as close as possible to the driver.*



# "Today, you need an oil this good."



"My bread and butter depends on this engine. That's why I need Quaker State."

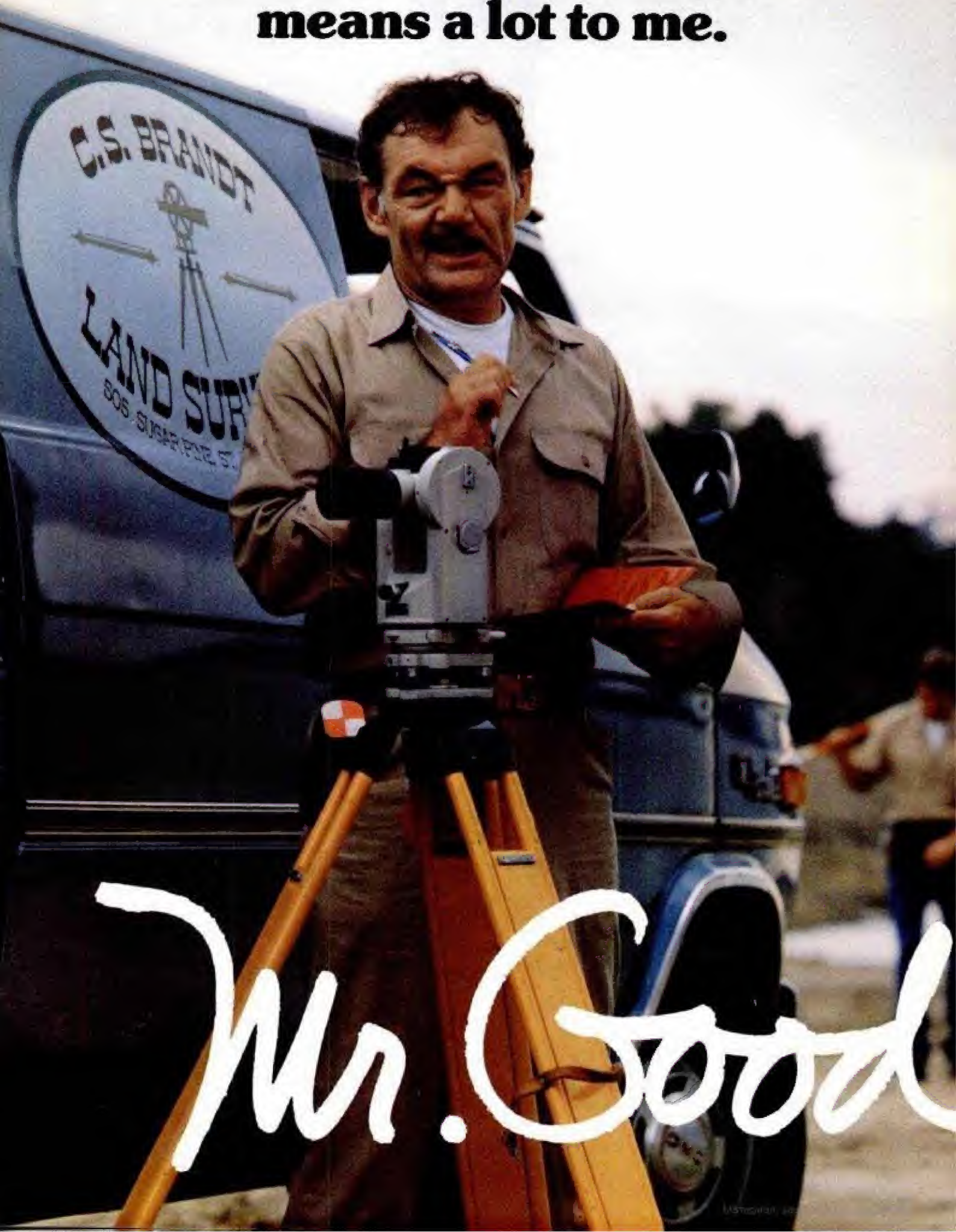
When you make a living with your vehicle, a costly breakdown can put you out of business. To keep your engine and business running smoothly, you need Quaker State quality. These Quaker State motor oils are made exclusively from Pennsylvania Grade Crude Oil. They offer quality protection for your vehicle. Quaker State: so good, it's America's best selling motor oil.

## Quaker State





**Professional service  
means a lot to me.**





# That's why I see Mr. Goodwrench even for simple jobs like brakes—or shocks.



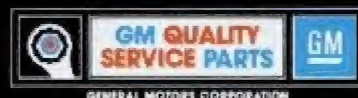
A professional technician is committed to doing his work right. He doesn't just slap-dash a job together, sometimes he spots other problems that are about to happen. That kind of careful workmanship could save you money—keep a little problem from getting big. And costly. That's why I take my van to Mr. Goodwrench. He's a pro.

Mr. Goodwrench has GM training available to him, plus he has the right tools and he can get genuine GM parts. And even though I feel like he's worth more to me, he's committed to charging reasonable prices—he has pledged to be competitive with other places I can go around here for service.

So keep that great GM feeling with genuine GM parts at participating independent Mr. Goodwrench dealers selling Chevrolets, Pontiacs, Oldsmobiles, Buicks, Cadillacs, GMC and Chevy Trucks.

LET'S GET IT TOGETHER...BUCKLE UP

# Mr. Goodwrench





# DETROIT LISTENING POST



## GM minicars

Apparently to demonstrate that it hasn't abandoned the bottom end of the U.S. market in its future planning, General Motors has been showing a tiny, two-passenger commuter (TPC) idea car at recent shareholder meetings. GM says there are no plans to build this car as such, but that certain of its features probably will turn up in future production vehicles.

The experimental fwd TPC is 33 inches shorter, 5 inches narrower and 6.6 inches lower than the current Chevette, yet has more usable space inside for its two passengers. It weighs only 1,040 pounds and uses flush, sliding window glass, plastic suspension springs and many other superlight-weight engineering and aerodynamic innovations.

With a 0.8-liter, port-fuel-injected, aluminum three-cylinder engine, five-speed manual transaxle and a drag coefficient of 0.31—but without any weight-adding emissions or safety equipment—it delivers an astounding 67.5 mpg in city driving and 95 mpg highway.



*This tiny vehicle is a serious study of the possible transportation modules of the future. Lightweight materials and small motor will yield near-100-mpg efficiency.*

Meanwhile, GM chairman Roger Smith acknowledges that his company plans to import 200,000 to 300,000 fwd subcompact "R-cars" from Japanese partner Isuzu, plus 100,000 or so even smaller cars from Suzuki, both beginning in mid-'85. Rumors indicate that another 300,000 of the Isuzu cars may be GM-built in the United States.

These will be about 156 inches long (9 inches shorter than Chevette) on a 94.5-inch wheelbase. They'll be powered by a 1.3-liter Four, with a 1.5-liter diesel optional, and should get 40-50 real-world miles per gallon. The small-

er Suzuki minis will do even better with their 1.0-liter gas engines.

I don't know yet how these plans will affect the pending deal that would have GM assembling 200,000 fwd Toyota Corollas (to share with Toyota) in a U.S. plant at about the same time; but I do know that none of these cars is intended to completely replace the current rear-drive Chevette.

Why? Because it's the cheapest and simplest volume car built in America, and Chevrolet general manager Bob Stempel believes there's a market for that for some time to come.

## Buick's potent six-packs



*Buick's 3.8-liter V6 in road race trim.*

For decades, the Chevrolet small-block V8 motor has been the engine of choice for hot-rodders, racers and high-performance street applications. The reason

was simple. The engine was, and is, virtually indestructible and the high-performance parts necessary to make it go fast were, and are, all available right from Chevrolet.

With a copy of the Chevy Power book, a large wallet and a cooperative

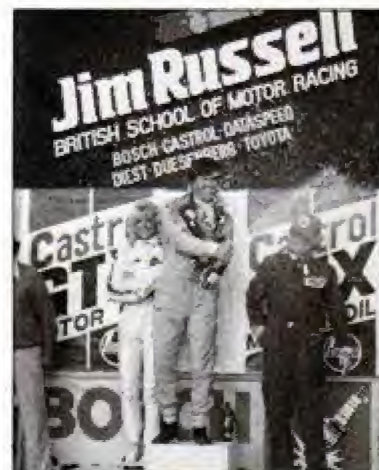
dealer, you can build as awesome a motor as you want without ever going to the aftermarket.

Buick would now like to be in the same market, but they would like to do it with their 3.8- and 4.1-liter

*(Please turn to page 16)*

## PM wins again

Remember our victory in the Quaker State Longest Day of Nelson Ledges (*Only The Strong Survive*, page 92, Nov. '82)? Well, PM chalked up another victory when Detroit Editor Gary Witzenburg won the coveted Jim Russell/British School of Motor Racing Media Challenge crown for '82. Behind the wheel of the single-seater Formula Fords were representatives of *Sports Illustrated*, *Autoweek*, *Motor Trend*, *Road & Track* and *On Track*. After two days of qualifying and heat races, Witzenburg came in first, with *Motor Trend* editor Tony Swan second and *Sports Illustrated's* Sam Moses third. On victory stand (left to right) are Linda Vaughn, Gary and Swan.





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PM-M



## DETROIT LISTENING POST

(Continued from page 14)

V6 motors. Buick has drawn on the collective experience of engine builders like Jim Ruggles, Jim McFarland (of Edelbrock frame) and Smokey Yunick and published the Buick V6 Performance Guide.

Like the Chevy Power book, it tells you in exacting detail, everything you need to know to massage a V6 into high-performance trim. The book and parts are as close as your Buick dealer.

Buick is campaigning hard to shed its image as a maker of stodgy family cars

and wants to associate its name with exciting performance. With its emphasis on the inherently more fuel efficient V6, rather than an 8, it seems to be right on target for the '80s.

### Is faster safer?

An interesting bit of contradiction was recently issued by the Highway Users Federation. In August 1982 the group issued an alarm that traffic deaths would increase for the year because, according to its surveys, 7 out of 10 drivers exceed the national 55-mph speed limit. Woodrow Rankin, a direc-

tor of HUF, said, "We're seeing a return to slightly faster traffic on roads that were designed for 60 mph."

In a state-by-state breakdown, it was found the Western states were the biggest offenders, with North Dakota topping the list at an average 57.8 mph. On the whole, we are a nation of scoff-laws on the interstates.

Those sobering predictions didn't come true, however, because in November that same group issued statistics stating that traffic deaths would set a record low in 1982. For the first six months of '82, 3,000 fewer people lost their lives than in '81. That's a 13 percent reduction in fatalities.

The numbers aren't all in yet, so no conclusion can be accurately drawn, but it appears that while more of us are driving faster, fewer of us are involved in fatal crashes.

### Fwd Mustang/Capri

Ford is working on the next-generation Mustang/Capri for mid-'85 introduction, and both are said to be lighter, shorter and very different in styling, compared to the current models. Also—surprise—front-wheel drive.

They'll use transverse power trains from the coming Tempo/Topaz compacts, including an optional turbomotor, plus further developments of the Escort/Lynx front suspension and the more sophisticated Tempo/Topaz rear suspension.

That will leave the new T-Bird and Cougar as Ford's only rear-drive sporty cars—until they, too, go fwd for '87.

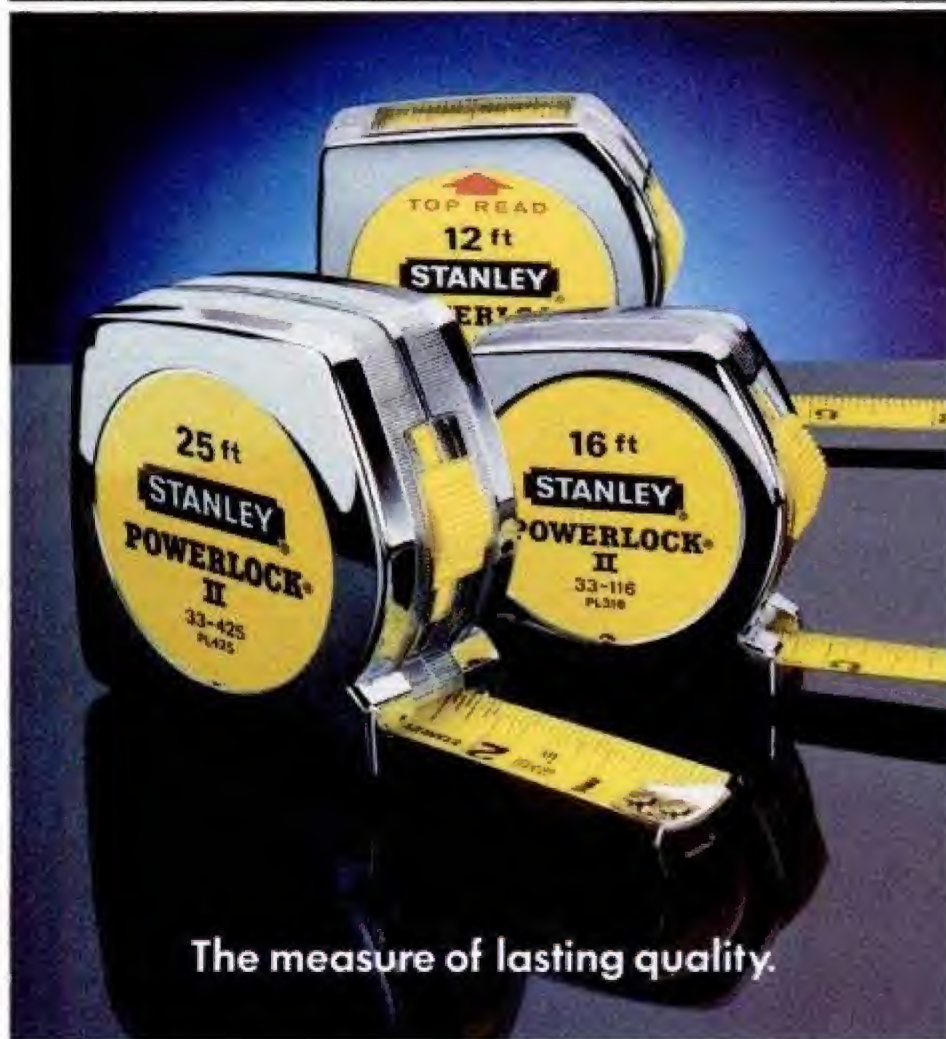
### Mirada/Cordoba/Imperial

Chrysler's three remaining rear-drive luxury coupes, Chrysler Imperial and Cordoba and Dodge Mirada, are also likely candidates for a downsize and fwd conversion in 1985. Like everything else in Chrysler's stable larger than the Omnirizon's twins, these will be built on the company's versatile K-car platform—but with their own unique sheet metal and "formal" look.

### More factory racing?

According to the latest J.D. Power Automotive Consumer Profile, the time couldn't be much riper for U.S. automakers to increase their motorsports activities. More than 25 million American drivers are interested in auto racing, and 24 to 36 percent of the people surveyed (depending on geographic area) said they favored more active participation by automakers. As expected, the majority of those showing a strong interest were young males—but a surprising 10 percent were women.

FM



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CAR  
CLINIC

## Family feud

*Since the day I drove my 1981 Pontiac Trans Am out of the showroom, the 4.9-liter engine has had a rough idle and has hesitated on acceleration. I brought the car back to the dealer several times and was told that everything is adjusted to specification.*

*Then, one day I took the car to a Buick dealer. He checked it out and told me that one of the two ports in the four-barrel carburetor throttle pump chamber had not been drilled. He did the job, and the car has been running fine ever since.*

*I sent a letter to the Pontiac regional office in Cleveland to get them to pay for the job—after all, the problem had*

*started while the car was under warranty. The regional office told me that the port was not drilled because of emissions standards, and that Pontiac wouldn't pay for the job, because it violated emissions laws.*

*Back to the Buick dealer I went, and was told that Buick uses the same engine and carburetor, and that both ports are supposed to be open. Who's right—Pontiac or Buick?—Jim Phillips, Maple Heights, Ohio*

*Buick! Pontiac should pay for the job. Call the Cleveland office again and speak to Ed Balas. Ask him to call Jim Colyer of Pontiac service in Pontiac, Mich. Jim knows all about this.*

problem. That's why vehicles driven only around town should be taken on the open road at least once a week and driven for a minimum of 15 minutes at highway speed. This gets the engine hot enough to purge carbon from the cylinders. It also allows the O<sub>2</sub> sensor to reach a temperature which burns away carbon that's accumulated in it.

## Hotfoot

*My 1980 Datsun 310 starts and runs fine. The trouble happens when I turn the engine off and restart it. Then it runs lousy—bucking and surging—until I lean into the accelerator pedal. This seems to clear up the problem. Can you tell me the cause?—John Stillman, Waltham, Mass.*

The A-series engine in your car may be subjected to conditions that are causing fuel to percolate when you shut off the engine. Percolating fuel escapes from the fuel bowl and floods the cylinders. Then, the engine runs badly until you accelerate rapidly, which clears the overflow.

If this, indeed, is what's happening, there are two ways of solving the problem. First, check the carburetor fan, which is mounted on the right strut tower facing the rear of the carburetor. The carburetor sits right above the exhaust manifold and, therefore, is

*(Please turn to page 22)*

## Solution without a reason

*A few months ago, I purchased a 1982 Plymouth Horizon TC3 hatchback. The hydraulic valve lifters have been rattling from day one. I've taken the car back to the dealer who claims that nothing can be done about it. I would appreciate your help.—Bill Newcome, Brookville, Pa.*

Although you don't say so, I'm assuming the car has a 2.2-liter engine rather than the 1.7-liter. Why? First, because the 1.7-liter engine has mechanical valve lifters which, if adjusted properly, will not make noise. Second, because there have been reports of some 2.2-liter engines making noise.

Chrysler admits that it's happening, and that the noise is confined to the valve lifters. However, the cause has escaped detection.

According to Chrysler, treatment with engine oil supplement (Chrysler part No. 3419130) will get rid of the noise, but I still wouldn't let the condition slide by. Instead, get this problem on record and keep notes of what was done to try and correct the situation. Then, if it works into a serious condition later on, you'll have ample ammunition for a claim.

## Dry Martini

*I heard that additives such as Heet and Dry Gas that get rid of moisture in gas tanks and lines will damage the oxygen*

*sensor. Can you confirm or deny this? I own a 1981 Buick Skylark.—John Helm, Quincy, Ill.*

You heard wrong. A fuel-line additive having an alcohol base to dry moisture won't have any adverse effect on an O<sub>2</sub> sensor. However, let me tell you what will.

If you make repairs that require new gaskets, and you use an excessive amount of RTV or anaerobic sealer, and some of it flakes off into the engine and burns, fumes can contaminate the sensor. Furthermore, carbon can be a real

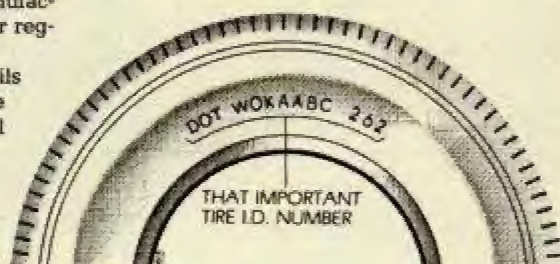
## Tire law lowdown

Under a new federal law, independent tire dealers are no longer required to register tires for you. They're only required to give you a registration form containing the tire identification number. It's your responsibility to complete the form with your name and address and then mail it back directly to the tire manufacturer.

The Tire Industry Safety Council suggests that you do this in case the manufacturer has to notify you about a recall. (Tire outlets owned by tire manufacturers and/or bearing the name of the manufacturer are still responsible for registering customer tires.)

Incidentally, if a dealer fails to give you a form, make sure that you get one and fill it out yourself.

You will find the tire registration number right on the tire. It's preceded by the letters DOT.







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# AIR FORCE

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## CAR CLINIC

(Continued from page 20)

subjected to a heavy concentration of heat. The fan, which is supposed to turn on when coolant reaches approximately 162° F., blows excessive heat away from the carburetor. Make sure this fan is working. If it isn't, the carburetor is having the hots and causing fuel to percolate.

The second thing to look at is a service bulletin that calls for the installation of a different needle and seat. These new parts supposedly prevent percolating fuel from leaking out of the fuel bowl into the cylinders. The part number for this new needle and seat is 16101H9060. Refer your dealer to technical service bulletin 82-0-84 in the engine fuels section.

### Peanut brittle

At 18,000 miles, I had to have the muffler and tailpipe of my 1978 Chevrolet Malibu replaced. They had been leaking rusty water for a while before the tailpipe broke off.

After having these new parts installed, I was called out of town for several weeks. When I came back and started the engine, chips of rust flew out of the tailpipe. I now have 19,000

miles on the vehicle. Do I have another exhaust system replacement to look forward to?—Anthony Militello, Toms River, N.J.

Probably. You drove 18,000 miles in four years. That's an average of 4,500 miles a year or 12 miles a day, which is peanuts.

At these short distances, the engine never gets hot enough to burn off water, which is a byproduct of combustion. This water is collecting in the exhaust system and rusting parts—a

common complaint among short-distance drivers.

All in all, when you consider time, and not mileage, a new exhaust system every four years isn't really such a bad record.

### From the King of Montebello

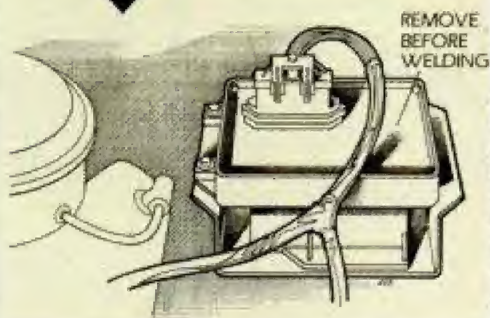
My 1981 Honda Accord has a hard-starting problem only when the engine is hot. Dealers have adjusted the carburetor, replaced the fuel filter, replaced

PM CAR CARE



### Don't KO your computer

If you need to have welding done on your car and it's equipped with a computer, be careful. Remember: Welding can damage that \$300 black box. In order to guard against this, disconnect and remove the computer from the car before welding.



You also run the risk of damaging the computer when you jump-start a car. You can avoid this by turning off the ignition in both cars before you connect the jumper cables. Then restart the car with the good battery and turn the ignition key of the other car. After the engine of the weak-battery car starts, let both cars run a few minutes to charge the weak battery. Then, shut off both engines before you disconnect the jumper cables.

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by Philip E. Brancato Sr.

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I tried all those "Get Rich" gimmicks that are advertised, that never tell you anything until you've sent them your \$25, and then you find out their gimmicks were not for you. Well, I've tried them all and I'm still not rich.

All I ever wanted was something I could do in my spare time with my hands, make a little money and enjoy myself and not have to buy \$3000 worth of tools or merchandise to do it.

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I found the most enjoyable and profitable business working with my hands and the only tools I use are a hack saw and measuring tape. The really nice thing about it is any man, woman or ten-year-old can do it.

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Just go look at some of this furniture in the stores and see some of the unbelievable prices it is selling for.

A chaise lounge that costs \$42.25 in material and three

hours of work is selling for over \$228 in the stores. I can sell my chaise lounge for anything I think my labor is worth. For once, the big manufacturing companies cannot compete with me or you on prices. You will find you will have more orders than you want!

## Where can you buy the P.V.C. Pipe?

You can buy the P.V.C. pipe from any local hardware store to start. Plus I will supply you with the names and addresses of cushions and pipe manufacturers who will sell to you wholesale, plus I will supply you with my shop manual and six detailed shop drawings with pictures and measurements of six different designs.

## Do you need my shop drawings

No, you don't need my shop drawings unless you want to save hundreds of hours of trial and error work and thousands of dollars that I had to spend before I finally

found the right design and measurements and tricks to the manufacturing of P.V.C. pipe furniture. I only wish that when I started, I could have bought these shop drawings and I would have gladly paid \$100 for just one of them.

## I will pay you!

Yes, I will pay you \$25 for any unique design shop drawing that I can use in my collection and workshop manual.

## How do you start?

1) Decide if you like to work with your hands to create things and want to make money.

2) Can you afford \$12.00 for my shop manual and six drawings.

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sparkplugs and replaced the carburetor float. The problem remains. What can I do about it?—Edward King, Montebello, Calif.

Have a cooling fan kit installed. It'll get rid of heat that's causing fuel percolation after the engine is shut off. The kit, which consists of an air temperature sensor and timer, automatically turns on the cooling system fan when the engine is off if under-hood temperature is too high. This gets rid of heat.

Percolation can affect not only a 1981 Accord, but also 1980 and 1982 Accords, 1980-82 Preludes and 1982 Civics. Fan kits for the various models differ, so make sure you get the correct one. Here's a list of models and Honda control numbers for the kits they need:

- 1980-81 Accord, 127615.
- 1982 Accord, 126459.
- 1980-81 Prelude, 126462.
- 1982 Prelude, 126461.
- 1982 Civic, 126458.

If you have a 1980 Accord or Prelude you should also be aware that a restriction in the original fuel evaporation canister can cause a flooded carburetor; this prevents engine restarting when the engine is warm. The original canister was replaced with a new one that's identifiable by two white paint

dots on its top. If you still have the old canister, you should have the new one installed. It carries Honda control No. 099795.

## Time warp

In your article on SE and SF engine oils (Car Clinic, page 44, Aug. '82) you said, "If I owned a 1980 GM model and were using SE oil, I would switch to SF."

Since the recommended oil change for my 1980 GM diesel is 3,000 miles, and it's 5,000 miles for 1981 models that use SF oil, would you say I could also change oil at 5,000 miles if I switch to SF?—John E. Mysza, Atlanta

I should say not. Even if you switch to SF oil, maintain the 3,000-mile oil interval. The reason is that your car has a standard cam-and-follower valve train. The valve train in 1981 and newer diesels have a roller-cam arrangement that operates with less friction. If you extend the servicing interval in your 1980 GM diesel, you'll subject the valve train to excessive stress. **PM**

## DO YOU HAVE A CAR PROBLEM?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be discussed in the column.

## SERVICE TIPS

■ General Motors has extended the warranty coverage on front-axle seals and shifter forks of 1980 X-body cars built through December 1980 to five years or 50,000 miles, whichever comes first. Transmission fluid leaks and defective shifter forks have been a problem. It's not a recall, so you won't get a notice. If you have trouble, return the car to a dealer who will inspect it and replace the seals and shifter fork, if necessary. If you've already paid for repairs you can get reimbursed by GM upon presentation of pertinent records.

■ If the 3.8-liter engine in your 1982 Ford or Mercury uses too much gas, have the dealer check article No. 82-20-9 of technical service bulletin 82-20. Then get a new fuel-enrichment valve installed. If your car is a T-Bird, Granada, XR-7 or Cougar, the part is either No. D5DZ-98565-A or D5AZ-98565-A.

■ If the 1.7- or 2.2-liter engine in your 1978-82 Chrysler car has a Holley carburetor 5220 or 6520, you could have a strange condition. The car may operate fine, but suddenly develop a poor idle because of a plugged idle circuit. You may need to replace the carburetor air horn or have the carburetor torn down and cleaned. TSB 14-32-82 explains this.



# APPLIANCE CLINIC



## Burning issue

I own a Montgomery Ward Signature electric range, model No. 4366, serial No. 88120772. When the oven is set for 325° or 350° F., the temperature in the oven goes to nearly 500° F. The thermostat has been replaced four times. After each installation, the serviceman checks the operation and it works fine, but the problem returns at a later date. What, besides a faulty thermostat, could be causing this problem?

—George W. Scott, Merrimac, Mass.

Perhaps the wrong replacement thermostat was installed. I contacted Montgomery Ward and they suggested that you write to Frank Cauweld, Montgomery Ward Plaza, Customer Service, Div. 4N, Chicago, Ill. 60671. Send him the name and address of the appliance service company that installed the replacement thermostats, and the part numbers of those replacements if you can. He'll handle your problem from there.

**Note:** Some models have a grommet on the end of the drain tube. Remove, rinse and reinstall this grommet. If the grommet is badly deteriorated, replacement part No. 849307 is available at a Whirlpool parts outlet.

## An agitated owner

We have a Maytag washer model No. A106, serial No. 014710AE. Occasionally a large item, like a towel or bath mat, comes out of the washer torn or with a hole in it. I can't find any sharp projections in the tub. Can you help?

—Sam Kamilos, Carmichael, Calif.

The Maytag agitator design has been around for many years. It's designed to push the water through the clothes, rather than drag the clothes through the water. The clothes tumble from the top of the machine to the bottom, away from the agitator. The only time something can get caught under the agitator is when the washer is overloaded and there's too little water in the tub.

I suspect that you're not using enough water for the amount of clothes in the tub. Another possibility is that the clothes have been weakened by chemical damage due to improper bleach usage.

## Faulty freezer

Help! I have a problem with my Sears refrigerator, model T-14-G-1, serial No. 26113374. The refrigerator itself keeps cool enough, but the freezer won't freeze. The cold control is on high and the manually operated defrost cycling clock works fine. Any suggestions?

—Eloi A. Laliberte, Lewiston, Me.

Sounds like your problem is the restriction of airflow between the refrigerator and the freezer section, caused by ice buildup on the evaporator. This could be caused by a defective defrost bimetal or defrost heater, or possibly by a defrost timer not functioning properly. I suggest you have a service technician inspect the unit and determine which part(s) you need. **PM**

## Glue for popcorn popper

Last year we purchased a West Bend Stir Crazy popcorn popper, model No. 15346. The popper works fine, but apparently we have butter fingers. We broke one of the handles off the base by knocking the popper off the counter. I tried to affix it with epoxy, but the first time it heated up the epoxy turned to goo and released. Is there any glue on the market that will stand up to the heat?—Roger McKee, Davenport, Ill.

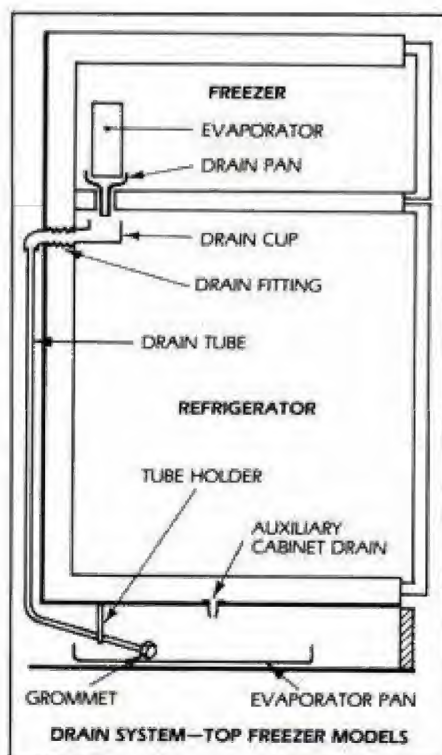
I contacted West Bend with your problem. They don't know of any over-the-counter product that will withstand the 375° F. plus temperatures to which the base is exposed. They suggest you contact a West Bend appliance repair center and have the base replaced.

## Water accumulation

Our Whirlpool refrigerator, Model EAT19PTWRS, serial No. S43940098 has water accumulating in the bottom. We keep a bath towel lying in the bottom and every few days, it becomes soaked with water. What could be causing this?

—R. H. Lundstrom, Northridge, Calif.

Sounds as if the drain cup located behind the back wall control panel has become clogged. To correct this, first unplug the refrigerator. Get at the drain cup by removing the two light covers on the back control panel, then remove the temperature- and air-control knobs. Remove the two hex-head screws under the console and lift out the console carefully. You will see the drain cup approximately in the center of the panel; pull the cup forward and



**Cross section showing the drain cup and drain tube: Be sure the evaporator pan is in place before cleaning out tube.**

out. Clean the cup with hot tap water.

Mix a cleaning solution of one tablespoon of baking soda to one cup of hot tap water. Fill a meat basting syringe with the solution and squirt it down the drain tube. Repeat this procedure several times to make sure the tube is thoroughly cleaned. Reinstall the clean drain cup, put the refrigerator back together and plug the unit back in. This should correct your problem.

*If you have a problem with any appliance, send your question, along with the model and serial numbers, to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.*



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Discover what's in Locksmithing for you — how Foley-Belsaw's Master Locksmith-approved training can give you the skill you can depend on to EARN MORE — ENJOY LIFE MORE.

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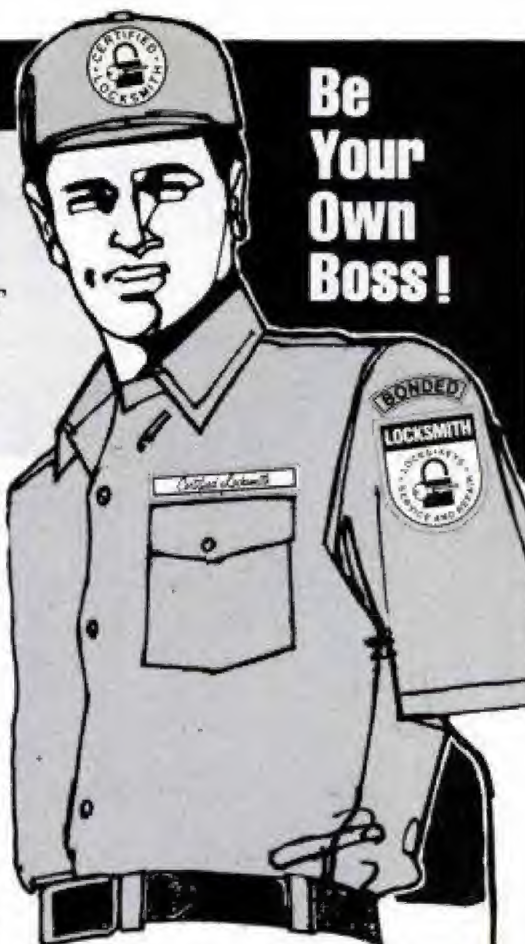


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**Be  
Your  
Own  
Boss!**



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have succeeded in this fascinating  
and highly profitable field...**

"Before enrolling I checked other courses and also asked for advice from several locksmiths in my area. They all said yours was tops and has the most versatile Key Machine."

"I always wanted to be in business for myself and now I am... thanks to Foley-Belsaw Institute."



David Fairbrother—Dave's Locksmith Service  
Milwaukee, Wisconsin 53209



"I opened my own business, spare time, seven months after I enrolled and made a profit of \$329 for the first week."  
B. A. Deberry Littleton, Colorado

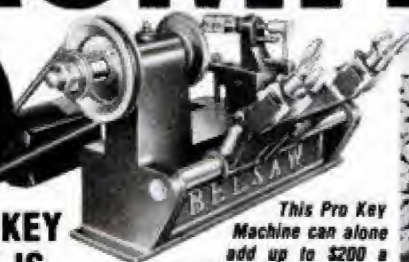
"No more hard, nasty work for me. Now I have my own business and with hardly any effort I average around \$50 a day. Thanks for my new start in life."

Sam Walker Prichard, Alabama



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## HINTS FROM READERS

### Cement mixer



A five-gallon plastic bucket makes an excellent no-mess mixer for small amounts of concrete, plaster or similar material. Screw or bolt two wooden or angle-iron mixing paddles on opposite sides of the inside of the bucket. Fill the bucket to approximately two-thirds capacity and snap the lid on securely. Now roll the mixer back and forth on its side until the contents have been mixed thoroughly.—*Wayne Fugate*

### End clogged downspouts



My gutter downspout openings were shielded by low-profile, perforated metal screens (see top of photo). Leaves and seed pods collected over these screens, causing the gutters to overflow during heavy rains. To eliminate the frequent cleaning, I replaced the commercial screens with home-made models.

Each nonclogging screen is made from a 6 × 9-in. piece of ¼-in. mesh hardware cloth (available at hardware stores and home centers). Roll each piece of cloth into a 6-in.-high tube to fit tightly in the downspout opening, as shown.—*Wilson G. Walters*



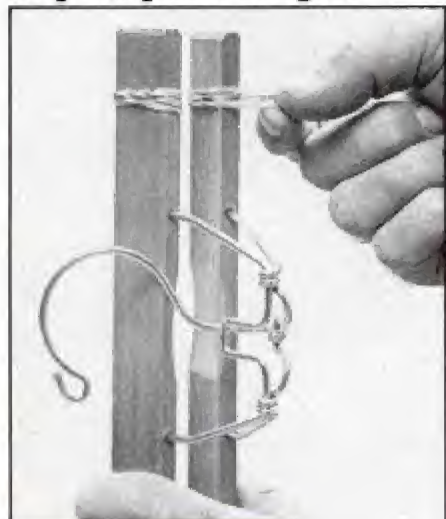
# HINTS FROM READERS

## Driving concrete nails

Here's a sure-fire way to drive nails into concrete. Bore a  $\frac{3}{16}$ -in.-dia. hole with a carbide-tipped bit. Whittle a sliver of wood to fit loosely in the hole, but flush with the surface. Now drive a hardened concrete nail. This method is equally effective in poured concrete, block and precast concrete, and it even works with ordinary nails.

—Philip L. Monner

## Grip for pants hangers



My clamp-on pant hangers had lost their gripping power, allowing the pants to fall to the floor. I solved this problem by winding rubber bands around the ends of the hanger. When the hanger's clamped, the rubber bands grip the pants, preventing them from falling. Adhesive-backed foam insulation also works.—Henry Fregly

## Start your own money making business!



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industry has grown so quickly, an acute shortage of qualified Small Engine Professionals exists throughout the country. When you see how many small engines are in use today, it's easy to understand why qualified men command such high prices—as much as \$17.50 for a simple tune-up that takes less than an hour.

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Campbell, California



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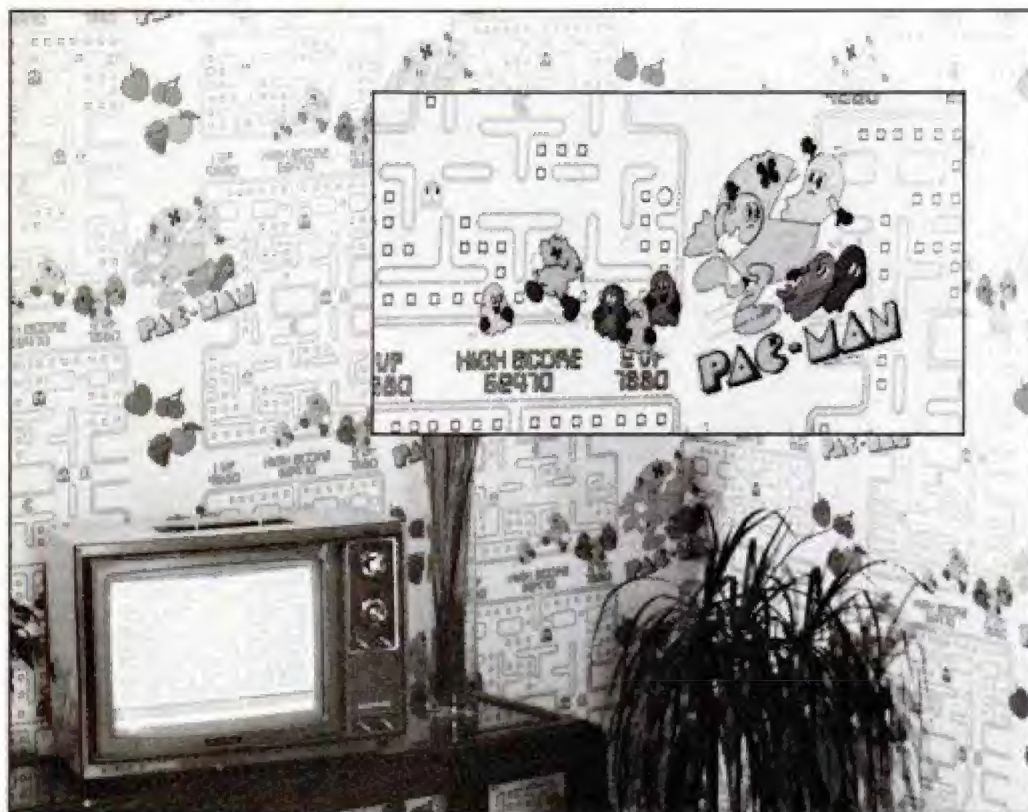
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### Pac-Man paper



Pac-Man, the popular video game character, is re-introduced on a new colorful wall covering from Color Tile Supermarts Inc., Box 749, Dept. RL, Fort Worth, Tex. 76101. The easy-to-clean vinyl wall covering comes prepested for quick do-it-yourself installation. The video game's grid pat-

tern is reproduced in medium blue on white; Pac-Man is bright yellow and the ghosts are pink, red, blue and orange. Each 20½-in.-wide roll, containing 70 sq. ft., sells for about \$20. It's at home improvement/decorating centers, and at all Color Tile Supermart retail outlets.

### Ratchets with unique control

Stanley Tools has introduced a new line of ratchet wrenches featuring Flip-Drive control which enables you to change ratchet direction single-handedly. To do it, you simply press the Flip-Drive mechanism located on the ratchet head. Flip-Drive ratchets are sold separately in ¼-(\$10.65), ⅜-(\$13.49) and ½-(\$17.39) drive sizes. They also come in standard or metric socket sets. For a free brochure, contact Stanley Tools, Dept. PID-PM, Box 1800, New Britain, Conn. 06050.



### Superior spray lubricant

ExSIL spray and lube by General Electric is a new, silicone-based, lubricant/penetrant that is claimed to prevent corrosion when ap-

plied to almost any metal surface. The multipurpose spray is recommended for use on tools, sporting equipment and firearms. A quick spray application will keep doors and windows operating smoothly. The lubricant's silicone base is formulated with an anti-wear additive to extend its staying power. ExSIL comes in 2-oz. (\$1.50) and 9-oz. (\$2) spray cans—prices vary with dealer locale.

For more information contact General Electric Co., Silicone Products Div., Dept. PM, Consumer Products Operation, Waterford, N.Y. 12188.



### Small tiller has big features

Troy-Bilt Junior, a compact, rear-tine tiller designed for cultivating smaller gardens (up to 1,500 sq. ft.), is claimed to have many of the features found in larger machines. A 3½-hp, aluminum-block engine drives the tiller with two forward speeds and one reverse. The maker says Junior's 125 pounds are balanced well enough to permit single-hand operation. Maximum tilling depth is 6 to 8 in.; top width is 14 in. It's \$669 from Troy-Bilt, Dept. A1470-PM, 102nd St. and 9th Ave., Troy, N.Y. 12180. **PM**





# Wealthy Man Wants to Give You His Wealth Secret Before It's Too Late!

Dear Friend,

My name is John Wright. Not too long ago I was flat broke. I was \$30,000 in debt. The bank repossessed my car because I couldn't keep up with the payments. And one day the landlord gave me an eviction notice because I hadn't paid the rent for three months. So we had to move out. My family and I stayed at my cousin's place for the rest of that month before I could manage to get another apartment. That was very embarrassing.

Things have changed now. I own four homes in southern California. The one I'm living in now is worth more than half a million dollars. I own several cars, among them a brand new Mercedes and a brand new Cadillac. And as of now, I have \$178,000 cash in certificate of deposits in just one of my bank accounts in Beverly Hills.

I'm not really trying to impress you with my wealth. All I'm trying to do here is to prove to you that if it wasn't because of that money secret I was lucky enough to find that day, I still would have been poor or may be even bankrupt. It was only through this amazing money secret that I could pull myself out of debt and become wealthy. Who knows what would have happened to my family and me.

Knowing about this secret changed my life completely. It brought me wealth, happiness, and most important of all peace of mind. This secret will change your life, too! It will give you everything you need and will solve all your money problems. Of course you don't have to take my word for it. You can try it for yourself. To see that you try this secret, I'm willing to give you \$20.00 in cash. (I'm giving my address at the bottom of this page.) I figure, if I spend \$20.00, I get your attention. And you will prove it to yourself that this amazing money secret will work for you, too!

You probably are asking yourself, why is he sharing his secret with me? My response is, "why not". First, I've already made enough money to retire for the rest of my life. Second, my secret is so unique that we won't be competing with each other. Third, nothing is more satisfying to me than sharing my secret only with those who realize a golden opportunity and get on it quickly.

This secret is incredibly simple. Anyone can use it. You can get started with practically no money at all and the risk is almost zero. You don't need special training or even a high school education. It doesn't matter how young or old you are and it will work for you at home or even while you are on vacation.

Let me tell you more about this fascinating money making secret:

## FAST MONEY

With this secret the money can roll in fast. In some cases you may be able to cash in literally overnight. If you can follow simple instructions you can get started in a single afternoon and it is possible to have spendable money in your hands the very next morning. In fact, this just might be the fastest *legal* way to make money that has ever been invented!

## ALMOST NO-RISK

This is a very safe way to get extra cash. It is practically risk free. It is not a dangerous gamble. Everything you do has already been tested and you can get started for less money than most people spend for a night on the town.

## "WORK" AT HOME

One of the nicest things about this whole idea is that you can do it at home in your spare time. You don't need equipment or an office. It doesn't matter where you live either. You can use this secret to make money if you live in a big city or on a farm or anywhere in between. A husband and wife team from New York used my secret, worked at home in their spare time, and made \$45,000 in one year.

## SIMPLE

This secret is simple. It would be hard to make a

mistake if you tried. You don't need a college degree or even a high school education. All you need is a little common sense and the ability to follow simple, easy, step-by-step instructions. I personally know a man from New England who used this secret and made \$2 million in just 3 years.

## AGE DOESN'T MATTER

You can use this secret to make money no matter how old or how young you may be. There is no physical labor involved and everything is so easy it can be done whether you're a teenager or 90 years old. I know one woman who is over 65 and is making all the money she needs with this secret.

## NO PERSONAL SELLING

When you use this secret to make money you never have to try to convince anybody of anything. This has nothing to do with door-to-door selling, telephone solicitation, real estate or anything else that involves personal contact.

## LEGAL AND HONEST

Everything about this idea is perfectly legal and honest. You will be proud of what you are doing and you will be providing a very valuable service.

## NO LONG HOURS

It will only take you two hours to learn how to use this secret. After that everything is almost automatic. After you get started you can probably do everything that is necessary in three hours per week.

I know you are skeptical. That simply shows your good business sense. Well, here is proof from people who have put this amazing secret into use and have gotten all the money they ever desired. Their names are not mentioned here in order to protect their privacy but I have full information and the actual proof of their success in my office.

## PROOF

- A woman from Oregon started out by using my secret method in its simplest form. She later reported that it had brought her \$14,000 in cash.
- A man from Rhode Island applied my secret and with the help of his family, made over \$40,000 in a year in his spare time.
- A man from California, who was broke at the time, tried my secret and made \$147,000.
- On the basis of my secret, a husband and wife team from Virginia grossed over \$100,000 cash in eleven months.
- A man from California made over \$265,000 in one year, with this incredible secret.
- I talked to a man from Ohio, who now lives in Santa Monica, CA. He said: "Thank you for sharing your secret...with this amazing, yet simple secret, I received \$220,000 in just two months."

As you can tell by now I have come across something pretty good. I believe I have discovered the sweetest little money-making secret you could ever imagine. Remember — I guarantee it.

Most of the time, it takes big money to make money. This is an exception. With this secret you can start in your spare time with almost nothing. But of course, you don't have to start small or stay small. You can go as fast and as far as you wish. The size of your profits is totally up to you. I can't guarantee how much you will make with this secret but I can tell you this — so far this amazing money producing secret makes the profits from most other ideas look like peanuts!

Now at last, I've completely explained this remarkable secret in a special money making plan. I call it "The Royal Road to Riches". Some call it a miracle. You'll probably call it "The Secret of Riches". You will learn everything you need to know step-by-step. So you too can put this amazing money

making secret to work for you and make all the money you need.

To prove that this secret will solve all your money problems, I'm not even asking you to send me money. Instead, postdate your check for a month and half from today. Obviously it is not actually money because it is not negotiable for 45 days. You can easily stop payment on it any time you want. I can't cash your check for 45 days before I know for sure that you are completely satisfied with my material.

## IMAGINE HOW YOUR WHOLE LIFE WILL CHANGE IF YOU USE THIS SECRET TO GET ALL THE MONEY YOU NEED!

- You won't have to worry about bills.
- You will be master of your own time and fate and nobody can boss you around.
- You will have more time to spend with your loved ones and you will be able to take care of them in emergencies.
- You can have the house you want, the car you want, the vacations you want.
- And most of all, you will finally have PEACE OF MIND!

If you need (or just want) more money, there are a lot of reasons why you should take advantage of this amazing secret. (And I can't think of a single reason why you shouldn't). It will probably solve all your money problems forever. In fact, I am so completely convinced that my powerful secret works money miracles, that I'm willing to give you the most unusual *guarantee* ever offered. That is, if it doesn't solve all your money problems, I'll return your original uncashed check, plus an extra twenty dollar cash bonus just for doing me (and yourself) the favor of giving the secret an honest try according to my simple instructions.

## \$20.00 FREE!

There is no way you can lose. You either solve all your money problems with this secret (in just 30 days) or you get your money back *plus* \$20.00 in cash **FREE!**

Do you realize what this means? You can put my simple secret into use. Be able to solve all your money problems. And if for any reason whatsoever you are not 100% satisfied after using the secret for 30 days, you may return my material. And then I will not only return your original UNCASHED CHECK, but I will also send you an extra \$20.00 cashiers check just for giving the secret an honest try according to the simple instructions.

**I GUARANTEE IT! I have given references, therefore, there is absolutely NO RISK ON YOUR PART.**

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# SCIENCE WORLDWIDE

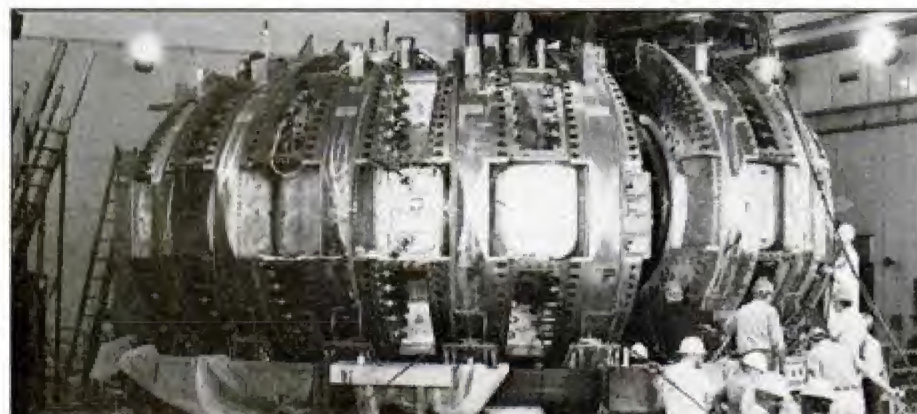


## Speeding toward a fusion conclusion

We reported last September that America was on the threshold of making the first fusion-generated electricity (*Fusion—We're Harnessing The Power Of The H-Bomb*, page 86). But we were surprised to learn the project is moving much faster than planned.

Grumman engineers put in the last protective panels covering Princeton's doughnut-shaped Tokamak reactor last November, a month ahead of schedule.

Now comes a period of shakedown runs, scheduled to culminate in 1986 with  $Q=1$ , the state in which the fusion reaction produces more energy than is needed to start the reaction in the first place. Officials of Ebasco Services, which manages the reactor, tell me even  $Q=1$  may come six months ahead of schedule, largely because of rapid improvements in computer, construction and other technologies.



Engineers put in the final protective panel at Princeton's Tokamak fusion reactor.

## Baying at the cargo bay

Anyone with a couple of thousand dollars can purchase a little space in the Space Shuttle's cargo bay. And some of the more than 400 students, businesses and private individuals who have purchased shuttle space already are planning to photograph Earth from inside the bay area, using automatic cameras.

Unfortunately, NASA has a big problem with the cargo bay's environment.

Using an Apple II computer, I recently spent some days communicating with Space Shuttle users who are concerned about the ship's directional thrusters.

The rockets, they say, scatter atoms across the open bay. These, in turn, scatter light, making photography difficult. NASA says it's working on various ideas for equipping the cameras with filters. But there's nothing that can be done about the directionals.

## Eely warning system

Swedish lake eels aren't electric, but they apparently use electricity to avoid being caught in fishing nets. A study of eels in central Sweden's Lake Hjälmaren indicated that the slight electric current generated by the Earth itself is "read" by a sonar-like mechanism in the eel's head.

Eels approaching fishing nets from a few yards away changed course quickly, apparently because the nets disturbed the surrounding geoelectric field. The eels were tagged with tiny transmitters and followed by radio signal as they migrated.

## Truck stop

Skid marks often help police estimate the speed of a car involved in an accident. But truck skid marks can be misleading, according to Pennsylvania State University engineer Gordon Hayhoe. "It seems truck tires have roughly a 10 to 15 percent reduction in the

coefficient of friction," he says. Thus, skid mark for skid mark, the trucks' are longer.

Hayhoe says much of the extra skid may be caused by the very hard compounding of rubber in truck tires.

## Fast alcohol, tight yeast

If manufacturers could turn sugar into alcohol quickly, America would have a very cheap fuel. And it just might, if Purdue researcher George Tsao's small-scale experiments work on a large scale.

Tsao has produced 100 grams (1/4 ounce) of alcohol per liter (slightly over a quart) of liquid sugar per hour by tightly packing the yeast cells that turn sugar into alcohol. Free-floating yeast cells, he says, produce about two grams of alcohol per hour from the same amount of sugar.

## In another vein . . .

The University of Utah, which brought us the first artificial heart implant, will soon be providing artificial blood vessels to people with vascular diseases. Utah researchers Donald J. Lyman and Dr. Dominic Albo head a team that has transplanted drinking-straw-sized plastic tubes into dogs, and the animals survived more than two years after implant surgery.

The blood vessel material is so flexible that it beats and throbs to the rhythm of the human vascular system. Human implants are scheduled to be done this year.

PM



Humans will receive plastic blood vessel implants like these sometime this year.



LIGHTS: 8 mg. "tar", 0.7 mg. nicotine av. per cigarette, FTC Report DEC. '81; FILTERS: 15 mg. "tar", 1.1 mg. nicotine av. per cigarette by FTC method.

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# HOMEOWNERS' CLINIC



## Bleeding redwood

*We installed redwood siding on the outside of our house 26 years ago, and painted it with the best exterior oil paint. Every spring since, the paint blisters and red stains appear. We've sanded the siding and applied latex paint over the best undercoat available. Still, every spring the paint peels and the red stains return. Any ideas?*

—Amy Alexander, Vienna, W. Va.

I believe interior room moisture (vapor) is passing through your walls and popping the paint. You need to treat the interior walls so warm, moist air won't pass through to the outside.

You can apply an interior paint designed to minimize the flow of moisture (such as Glidden's Insul-Aid), or place a polyethylene vapor barrier between the studs and the dry wall. (See "Mildew And Paint Peeling," *Homeowners' Clinic*, page 52, Oct. '80. For a copy of this article, send 50 cents

to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.)

Once you've corrected the moisture problem, scrape off the blistered paint and sand the wood bare. Prime the blistered area with an oil-base primer, then repaint the entire area. Note: Primers containing zinc are sensitive to water and should not be used on redwood.

Latex or other water-base primers should not be used on woods containing water-soluble extractives (natural moisture which can be drawn out), such as redwood or cedar. The water in the primer base will cause bleeding stains. Latex top coats may be applied over an oil primer.

For an excellent booklet regarding your problem, send 25 cents to the California Redwood Assn., 1 Lombard St., San Francisco, Calif. 94111. Ask for data sheet 4B1-3, *Painting Exterior Redwood*.

When the grains cover only 50 to 70 percent of the backing, the abrasive is an open-coat sandpaper. These don't cut as fast, but they don't clog easily.

## Sweating toilet tank

*All summer long our toilet tank sweats and drips water, especially when it's humid. We've tried several products, but they only work for short periods. One plumber suggested we hook up the tank to the hot-water line, but others had never heard of this. Who's right?—Morton Bender, Brooklyn, N.Y.*

Mort, the first plumber knows his business. When warm, moist room air hits your water-cooled tank and bowl, condensation forms. Tell your plumber to install a mixing valve that will flush your toilet with room-temperature water (not straight hot water). The valve can be adjusted to maintain the correct water temperature without wasting hot water.

## Spalled walls

*The concrete walls of our old home were originally poured in small batches. Now the walls are spalling (chipping and breaking up) at these joints, and a white, powdery substance forms during the decomposition process. A previous owner mortared over these areas, but that's flaking off, too. I'd like to chip out the bad spots, remortar and apply a sealer. Should I seal or remortar first, and what kind of sealer is best?—Dan Avery, Baker, Ore.*

Your condition is a moisture problem occurring at the nonbonded joints (cold joints) between the pours. Moisture has let water-soluble salts, a concrete chemical reaction byproduct, leach out. This is known as efflorescence.

Using a bricklayer's hammer and a cold chisel, chip the spalled joints clean and chisel the edges in a dovetail shape (undercut on the inside) at least  $\frac{3}{4}$  in. wide  $\times$   $\frac{1}{4}$  in. deep. Patch the joint with a compound such as Waterplug, then apply two coats of Thoro-seal waterproof coating to prevent any further moisture problems. Both Thoro-seal and Waterplug are made by Thoro Systems Products, 7800 Northwest 38th St., Miami, Fla. For the nearest dealer

call 1-800-327-1570. Florida residents call 305-592-2081.

## Open or closed abrasive?

*I'm 70 years old and have been using sanding belts since they first came out. However, I still don't know the difference between open and closed coats.*

—Austin Simmons, Lexington, Ky.



**Use closed-coat papers on surfaces that won't clog the abrasive (some metals, hardwoods). Open-coat papers don't cut as fast, but they're less likely to clog.**

Open- and closed-coat designations refer to the density of the abrasive grains (how close together they are) on the backing paper or belt.

Closed coat means that the abrasive grains cover the entire backing paper. Closed-coat papers cut much faster than open-coat grains, but they also clog more quickly. Use these on surfaces that won't clog papers quickly, like hardwoods and certain metals.

## Relinquishing support

*A support column in my basement is right in the way of my new pool table. Is there any way to remove that column without causing a sag in the floor above?—J.E. Miscoe, Pittsburgh*

As your drawing shows a girder joint over the column in question, I believe that removing the column would cause total collapse. Your problem can be corrected, but you should employ the services of a professional engineer.

Your structure will have to be temporarily supported to remove the existing column and girder. The new girder would span from the outside wall to the next column.

Sometimes flitch plates (steel plates bolted across girder joints for reinforcement) can be fastened on both sides of a wood girder to increase its span and to allow for the removal of a support column. Only an on-the-job structural engineer can tell you for sure. **PM**

*Do you have a home-maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in the column. For more home-repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send your order(s) to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.*





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# ALL OUTDOORS



## Learning fishing luck

The art of angling is becoming a successful science as well with the help of Indiana State University. It has recruited a faculty of top fishermen as instructors at Bass Fishing Institutes that are being scheduled at colleges around the country.

Classes that include demonstrations,

instruction and practice will run for two days, and youngsters under 16 can enroll with their parents at no extra charge.

To obtain registration details, contact the Bass Fishing Institutes, Indiana State University, Terre Haute, Ind. 47809.

## Pistols with more punch

For handgun shooters with a need for super power, Remington Arms is introducing a new high-performance sporting cartridge this spring, and Sturm, Ruger is producing a new revolver to handle it.

The cartridge will be called the .357 Remington Maximum. With a case 1.605 inches long, it is nearly one-third of an inch longer than the .357 Magnum. Loaded with a 158-grain, semijacketed, hollow-point bullet, the Maximum is reported to test out with a muzzle velocity of 1,825 feet per second (f.p.s.) from a 10½-inch vented barrel. Downrange, its velocity at 50 yards is 1,588 f.p.s. At 100 yards, the bullet travels at 1,381 f.p.s. and still has 669 ft.-lb. of energy with a drop of only 1.7 inches. That is a much flatter trajectory curve than the .357 Magnum and an even greater improvement over the .44 Magnum.

Metallic silhouette competitors and handgun hunters will find that smaller sighting adjustments are necessary for targets located at varying distances.

To take advantage of this extra pow-

er, Ruger has announced a new .357 Maximum Blackhawk revolver. Models with 7½-inch and 10½-inch bull barrels chamber the new potent cartridge.

Careful comparison with the Super Blackhawk .357 Magnum and .44 Magnum will show that both the cylinder and the ejector rod and housing are longer.

Both barrel lengths of the Maximum will have rear sights that are adjustable for windage and elevation. Frames will be blued steel, while the grips are square-back Dagoon style. Both will use the wide-spur hammer and wide, serrated trigger of the Super Blackhawk.

The energy generated by the Remington Maximum puts it in a class with the .44 Magnum. Yet initial tests indicate that, fired in the new Ruger .357 Maximum Blackhawk, the cartridge delivers considerably less recoil than experienced with the .44.

With 7½- or 10½-inch barrel, this model is hardly a concealed weapon. But with the longer sight picture of the large barrel and added impact, it should become a favorite for metallic silhouette contests.

## Rigid inflatable

It's a deep-V fiberglass hull with an inflatable collar, or a rubber blow-up boat with a plastic bottom—take your pick. Avon Inflatables builds the 24-footer in Wales and calls it the Searider 7.4. The U.S. Navy is giving it sea trials and refers to it as an RIB (for rigid inflatable boat).

For rescue work, fishery patrols and Coast Guard service it seems to be a happy compromise, since it has the high buoyancy of an inflatable, and sea-keeping qualities of a hard deep-V keel. It is rated to carry 18 men, mounts a 60-gal. fuel tank for its diesel sterndrive engine, and has a range of



*Avon's new Searider 7.4 is a combination hard-soft hull with advantages of both.*

300 miles with minimum crew or 200 fully loaded.

The blown-up sponsons, each with seven separate air chambers, are permanently bonded to each side of the hull and are of rubber-impregnated nylon that are claimed to have great wear resistance. As a dinghy, tender or club launch that has to bump up alongside various boats and docks, the craft could become a chubby-looking but useful pleasure boat, as well.

## What if?

Fortunately, chances seem to go down every year that we'll be lost in a wilderness or shipwrecked on a desert island, but what to do in an emergency is always interesting. Courses with Outward Bound and the National Outdoor Leadership School are one way to learn, and a good recent addition to the publications in this field is the *Wilderness Survival Handbook* by Alan Fry (St. Martin's Press). Fry gives a concise, all-seasons summary of what you need to know before you get in trouble. **PM**



*Ruger's Blackhawk .44 (top) has shorter cylinder than .357 Maximum (bottom).*



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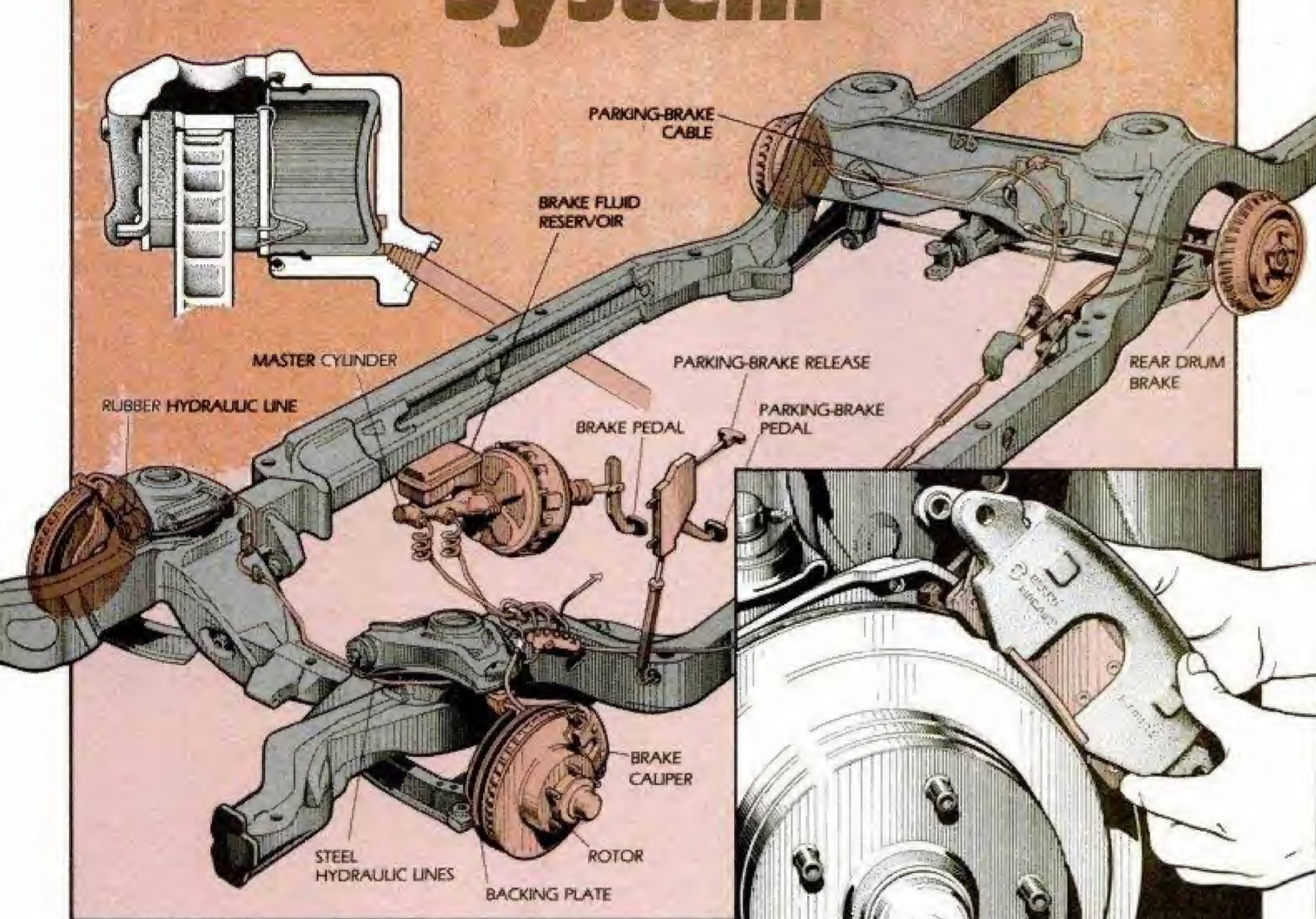
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# Troubleshooting Your Brake System



Today's typical braking system uses a two-stage master cylinder which operates disc brakes on the front wheels and drum brakes on the rear.

**B**rake-system maintenance is probably the most critical part of vehicle care. While the car that won't go may frustrate you, the car that won't stop can kill you. To avoid the complications that can occur when pads or shoes wear beyond limits, check brake condition at regular intervals.

Of course, brakes should always be inspected when their application results in noise or when the vehicle pulls to one side during braking. Some late-model GM and Ford products have brake-wear warning devices. But in

most cases, the only way to determine pad or shoe condition is to remove the disc caliper or the drum and inspect the friction material.

If the brake pedal pulsates when stopping, a rotor or drum is probably bent. If brakes don't perform as well as they should, if the pedal sinks or if the master cylinder loses fluid, the hydraulic system is probably at fault.

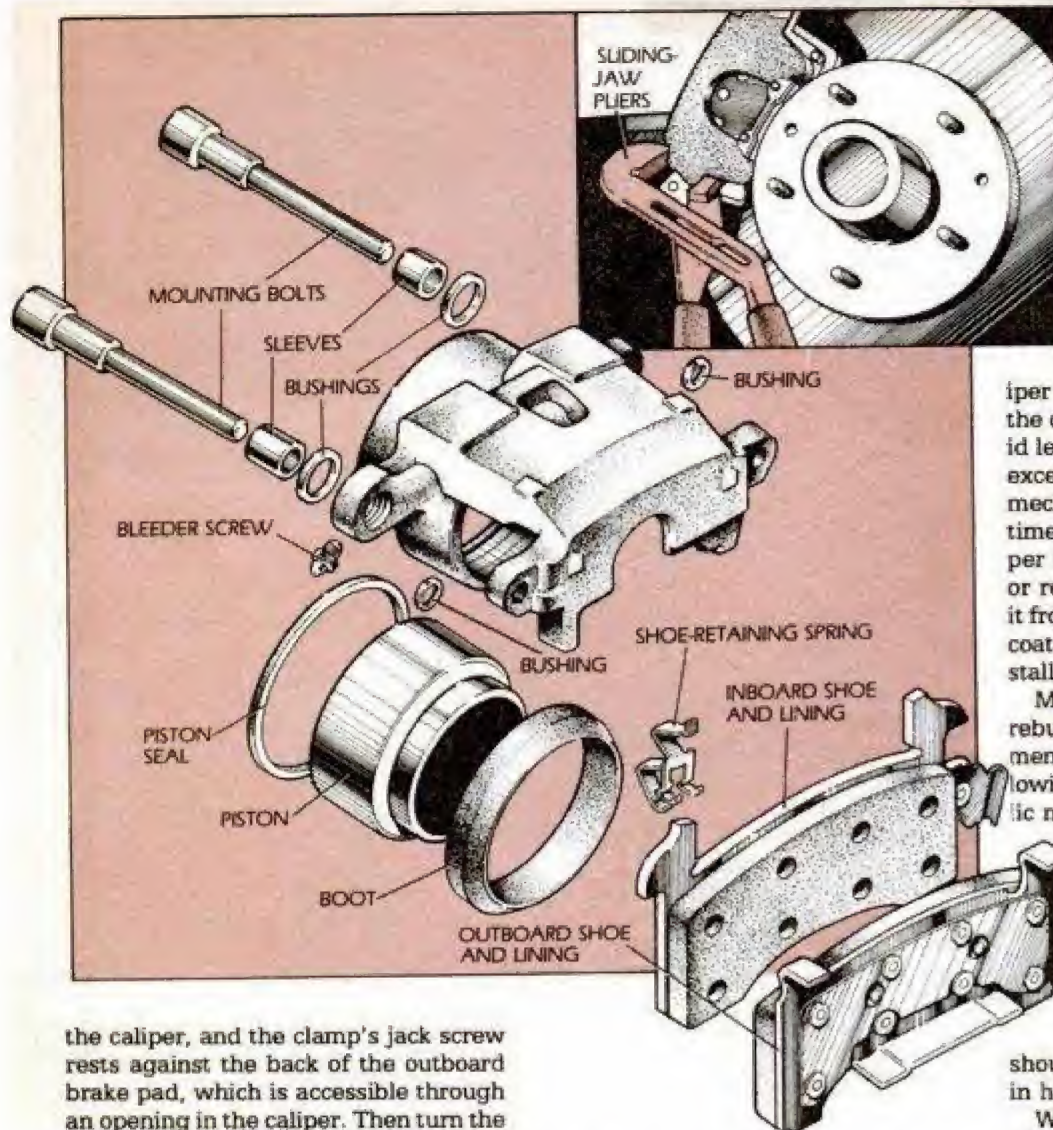
Before removing anything, inspect the entire brake system, including master cylinder, lines, valves, hoses and brake assemblies, for leaking

hydraulic fluid. If you find leaks, go to a professional.

## Caliper removal

To remove the pin-slider-type disc brake calipers found on most GM cars you'll need a 7-inch or larger C-clamp and a  $\frac{1}{4}$ -inch hex key wrench. After lifting and securing the vehicle, remove the front wheels. Siphon two-thirds of the fluid from the master cylinder. Then place the C-clamp over the disc brake caliper so that the pad on the top of the clamp rests against the back of





Most GM vehicles employ a floating-caliper disc brake at the front wheels. Piston and seals aren't removed from the caliper unless it must be rebuilt. Upon reassembly, clinch outboard pad ears over the caliper with sliding-jaw pliers as shown (inset).

iper surfaces clean and check around the dust boot and bleeder screw for fluid leakage. Inspect caliper bushings for excessive wear or deterioration. Some mechanics renew the bushings every time they remove a caliper. If the caliper is leaking it will have to be rebuilt or replaced. If the caliper's okay, hang it from a suspension arm with a piece of coat hanger until you're ready to reinstall it.

Most professional mechanics don't rebuild the caliper at every pad replacement. They contend that a road test following reassembly reveals any hydraulic malfunctions.

### Reassembly

When buying new pads, get the right type of friction material. Although inexpensive organic pads are available for some vehicles originally equipped with semimetallic pads, they shouldn't be used. Brake life may be cut in half.

While you're at the parts store, pick up a tube of brake silencing paste. Before installing the pads in the calipers, coat the back of the outboard pad with the paste and apply a strip of it to the back of the inboard pad. If there was an antirattle spring on the back of the old inboard pad, install it on the new pad. You can buy new antirattle springs if the old ones have been eaten up by corrosion.

Make sure the pads are retained in the caliper in the same manner as the old ones. On GM cars, you have to clinch the ears on the pad so that they fit tightly over the caliper. Squeeze them around the caliper with 12-inch sliding-jaw (slip-joint) pliers. Other pads may have pins in the back that fit into recesses in the caliper, or antirattle clips that hook into the caliper. The pads may differ from one side of the vehicle to the other. Check for left- or right-side designation.

When you reinstall the caliper, you may have to tap it into place on its mount, but don't use excessive force. If it won't go, the piston may not be retracted.

With pin-slider-type calipers, lubricate the pins before installing them, if the calipers have steel bushings. If they

the caliper, and the clamp's jack screw rests against the back of the outboard brake pad, which is accessible through an opening in the caliper. Then turn the jack screw, tightening it against the brake pad. As you tighten, the caliper should move away from the pad. This indicates that the caliper piston is being pushed back into its bore. If the piston won't retract, it may be frozen: See a mechanic.

Once the piston has been bottomed gently, the caliper guide bolts can be removed with the  $\frac{3}{8}$ -inch hex key wrench or an open-end wrench. Don't let the caliper hang from the rubber brake hose.

The procedure for removing non-GM calipers varies somewhat. In general, you should remove one caliper at a time, leaving the other side as a reference.

Most late-model Ford calipers are mounted similar to GM's. While the C-clamp is not necessary for caliper removal, you'll need a 4-inch clamp and a  $2\frac{3}{4} \times 1 \times \frac{3}{4}$ -inch block of wood to retract the piston once the caliper is off. Many Ford calipers slide on a machined surface and are held in place by a key. A locking screw holds the key in place. Late Chryslers use a caliper that slides on machined guides. These can be removed by disengaging the retaining clips that hold it in place. Other Chry-

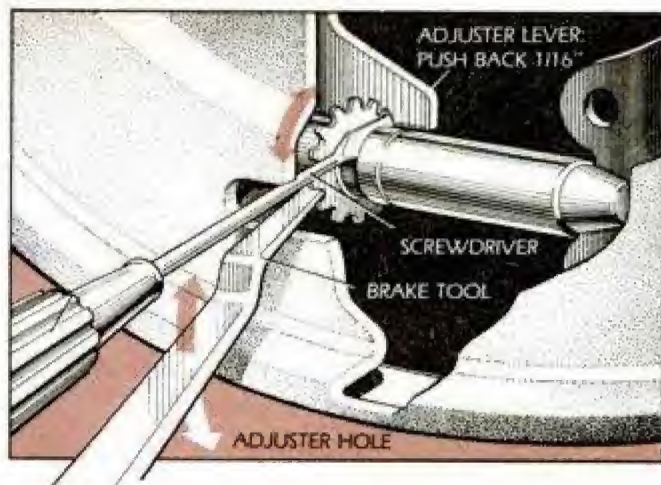
slers use a pin-slider caliper that retains the pins with clips.

### Inspection and diagnosis

Once the caliper has been disengaged from its anchor and lifted off the rotor, inspect the friction material. Nonmetallic pads should have more than  $\frac{1}{16}$  inch of material above the rivets. Semimetallic friction material should be at least  $\frac{1}{32}$  inch above the rivets. If the friction material is bonded to the pad without rivets, the thinnest section of material should be at least as thick as the backing plate to which it is bonded. If you still have a lot of friction material on the pads, bolt everything back together. If the rotors are discolored or heat-cracked, replace them. If you encountered the previously mentioned pulsating pedal, send the rotors to a machine-shop-equipped auto-parts store for resurfacing. Rotors should likewise be resurfaced if they're scored more than a slight amount. If your rotors are too thin or warped for remachining, the machinist will tell you that they must be replaced.

Once the disc pads have been removed from the calipers, wipe all cal-





To remove the rear brake drums on most cars, shoes must be retracted. To do this, locate the adjusting slot, reach in with a screwdriver and push the self-adjusting lever away from the star wheel. Insert adjusting tool and back off adjustment.

have plastic bushings, install the pins dry, but make sure they're clean. If they're slightly corroded, you can polish them with No. 400 emery paper. Some mechanics lubricate all pins, but other experts contend that this can cause excessive dirt accumulation. If the pins look bad, replace them.

Hold the caliper and pads in place while you install the pins. Tighten bolt-style pins to the recommended figure with a torque wrench.

After you've renewed or inspected all disc brakes, refill the master cylinder with DOT 3 brake fluid.

### Drum-brake basics

Drum-brake service is more time consuming than disc service. Again, it is extremely important that you disassemble the brake mechanisms one at a time, so that you have the other side for reference.

Before the front drums of rear-drive cars or the rear drums of front-drive cars can be pulled, you'll have to remove the wheel bearings. These must be cleaned, inspected and repacked with grease before reassembly.

The drums usually can't be removed until the brake shoes have been retracted. To retract the shoes on most vehicles with self-adjusting brakes, locate the adjusting slots, which are probably plugged with rubber inserts. Some adjusting slots may be blocked with metal slugs. In that case, knock out the slug with a hammer and chisel. Remove the insert, reach in with a very small screwdriver and push the self-adjusting lever away from the star wheel.

Hold the lever away from the wheel and insert a brake adjusting tool into the slot. Engage the end of the tool in the star wheel and turn the star wheel to back off the brake adjustment, using the edge of the slot as a fulcrum.

On most cars, the brake-tool handle should be moved upward to retract the brake shoes. Some Chryslers have a self-adjuster lever mounted behind the star wheel. For these cars you'll have to bend an old screwdriver or a piece of metal in order to reach the adjuster lever.

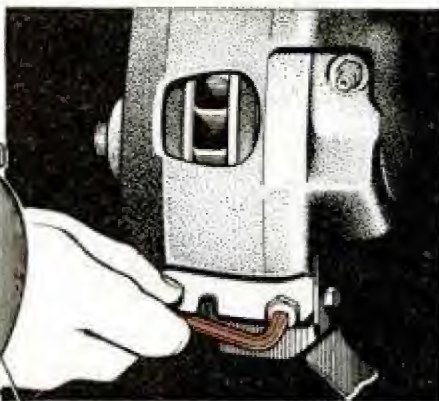
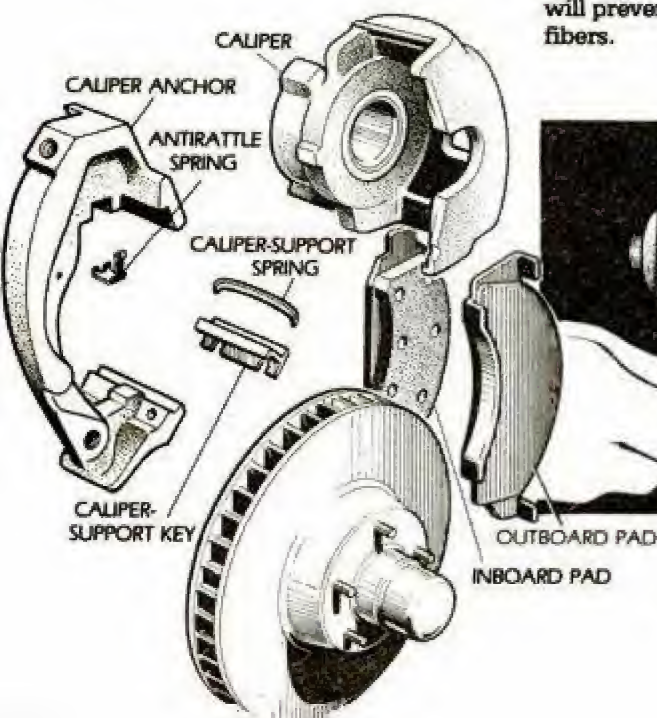
Before pulling the drums off the brake shoes, cover your mouth and nose with a breather mask, available where automotive paint is sold. This will prevent you from inhaling asbestos fibers.

Inspect the friction surface for scoring or other damage. If the drums are discolored or heat-cracked, replace them. If they are scored, take them to your parts store/machine shop for machining. Inspect the lining for wear. Bonded linings without rivets should be replaced when they wear down to  $\frac{1}{16}$ -inch thickness. Replace riveted linings when they wear to within  $\frac{1}{32}$  inch of the rivets. If the shoes are worn unevenly from side to side, have a machine shop check the drums.

### Disassembly

At the top of each shoe you'll probably find a return spring that secures it to an anchor above the wheel cylinder. This is best removed by inserting a brake tool between the spring and anchor. Turning the tool lifts the spring off the anchor. Some mechanics remove these springs by gripping them with a side-cutter and stretching them over the anchor. This is okay if the springs are going to be replaced, but not if the springs will be reused. Note the color and location of all springs, so they can be reinstalled correctly. You might want to color-code the old brake shoes with little dabs of paint to help in reassembly. Any springs that have been subjected to unusually high temperature or that have obviously stretched should be replaced. Some manufacturers recommend you replace the springs whenever the brakes are serviced. Once the springs have been disengaged, remove the shoe guide plate from the anchor pin.

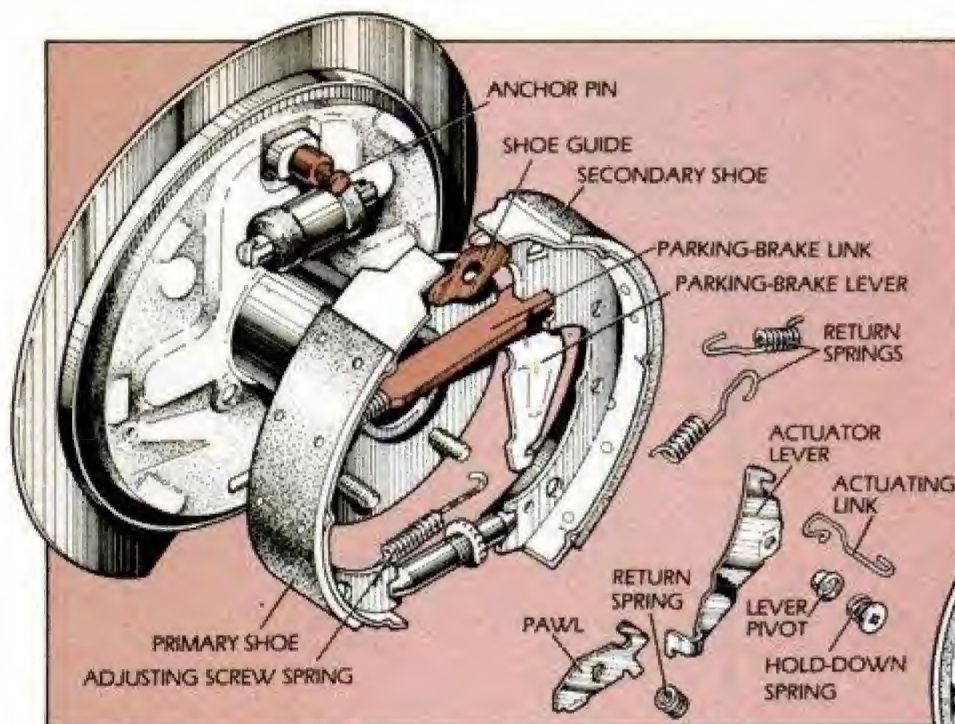
Most drum brakes are equipped with a self-adjusting mechanism that turns the star wheel when lining wear creates excessive clearance. Some of these mechanisms consist of a cable, a cable guide, a lever and a spring. Others use a heavy-gauge wire link, a pawl, a pawl return spring, a lever and an adjuster spring. To disassemble the cable type, the cable is detached from the lever once the spring has been stretched



The Ford-AMC machined guide caliper is retained by a support key and screw. To disengage the caliper, remove the retaining screw and use a hammer and drift to drive the retaining key out of the anchor.







The self-adjusting mechanism at left is typical of GM cars. The actuating link joins the actuator lever to anchor pin.

slightly by moving the lever away from the star wheel. Make a note of the hole in which the cable guide is inserted before removing the adjuster assembly.

Most brake shoes are attached to the backing plate by means of springs and retainers that lock on anchor pins. To remove, grasp the retainer between the jaws of a pliers, push down, and turn it until the slot in the retainer aligns with the locking tabs on the end of the anchor pin.

On many vehicles, you can remove the shoes with the lower adjuster connecting spring and star wheel adjuster in place. Most rear brake mechanisms have a parking brake lever attached to a shoe that must be removed.

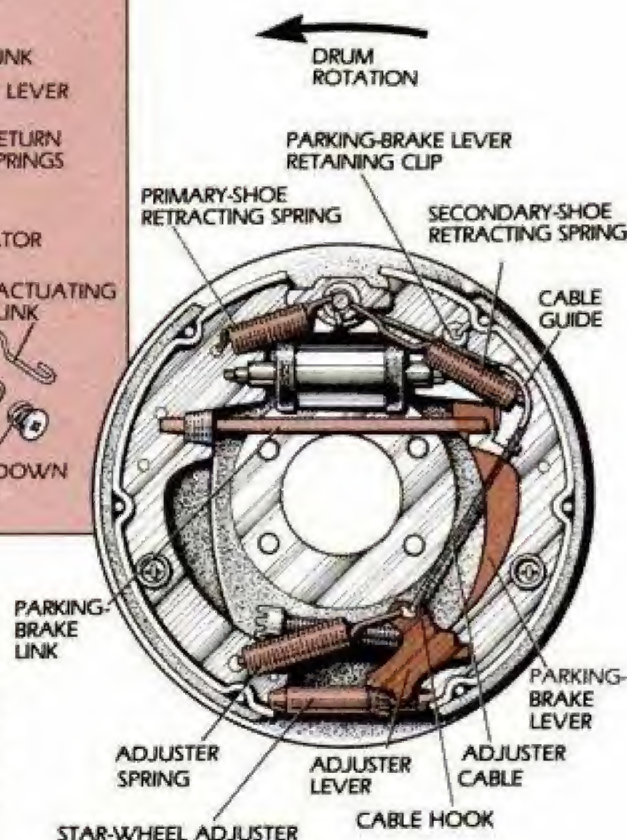
Before installing the new shoes, inspect the wheel cylinders by lifting the rubber dust shields on each end of the cylinder and looking for signs of brake fluid that may have leaked past the pistons and seals. If you find fluid, the cylinders should be rebuilt or replaced.

Once the cylinders have been replaced and the brakes have been reassembled, the system will have to be bled. Make sure no one depresses the brake pedal while the drums are off the car or the pistons will pop out of the wheel cylinders.

Clean the brake backing plate using brake-cleaning fluid and a rag. Be sure to use a protective face mask and don't blow brake dust off with compressed air.

Then compare your new brake shoes to the old ones to make sure they're the same. Look for shiny spots on the backing plate where the shoes make contact and lubricate these with a small amount of white lithium grease. If the

*Cable-type self adjuster on the right is typical of Ford, Chrysler and AMC vehicles. Cable is hooked over the anchor pin at top and connected to the lever at the bottom. The adjuster is actuated when brakes are applied while the vehicle is backing up.*



shoes have ridges worn into the contact pads, file them smooth before lubricating. Lubricate the star wheel adjuster with the same grease.

### Reassembly

Reassembly varies with different brake configurations. If you've left the other side intact for reference, you'll be able to determine the order of component installation.

To reassemble the common GM self-adjusting brakes install the adjuster connecting spring on the primary and secondary shoes along with the star adjuster. The wheel should be on the side with the secondary shoe. The secondary shoe is the one with more lining than the primary, and is installed toward the rear of the vehicle. The primary shoe, the one with less lining material, is installed toward the front of the vehicle.

Position the shoes on the backing plate, making sure the shoes engage the wheel cylinder push rods and that the parking brake lever, on rear-wheel applications, engages the secondary shoe.

Position the adjuster lever and its spring on the secondary shoe, and install the shoe hold-down springs and retainers. On rear-wheel applications, position the parking brake link and its

antirattle spring between the primary shoe and the parking brake lever. Place the shoe-guide plate in position over the anchor pin. Install the self-adjuster pawl and actuating link. Next, insert the hooked ends of the brake return springs into their respective holes in the shoes.

Then, using a large Phillips screwdriver or a brake tool, stretch the springs until they slip over the anchor pin. Install the adjuster lever return spring on the adjuster and stretch it until you're able to hook it to the adjuster pawl.

Once you've reinstalled the brake drum and wheel, use a brake adjusting tool to expand the lining against the drum.

Hold the self-adjuster lever away from the star wheel, as you did before. Turn the adjuster until you feel a heavy drag while turning the wheel. Then turn the adjuster 16 clicks in the opposite direction.

Road test the car. If the pedal pumps up, air has entered the system and you'll have to bleed it out. Make a number of stops in reverse to equalize adjustment on self-adjusting brakes. If the car doesn't brake satisfactorily after you've made 20 or 30 stops to seat the lining material, go to a professional for assistance.

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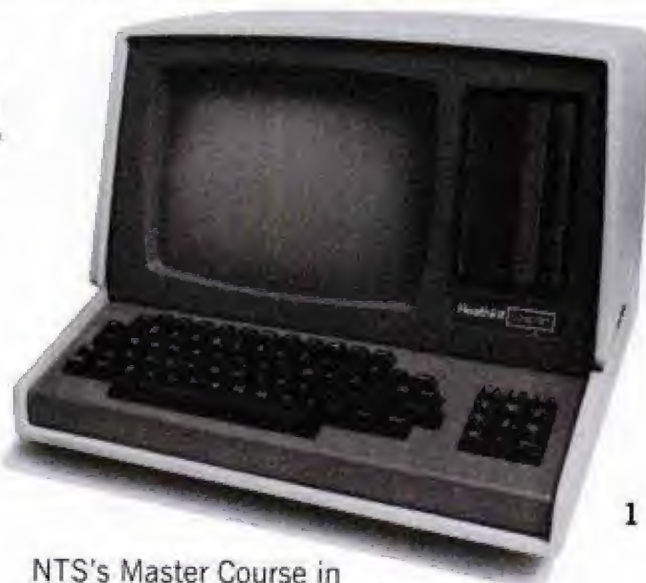


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1

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2

The **NTS/Rockwell AIM 65 Dedicated Microcomputer (#2)** is included in our Microcomputer Technology Course. It is a single board unit featuring an on-board 20 column alphanumeric printer with 20-character display. This 6502-based unit also has 4K RAM memory, (expandable,) 8K monitor ROM and 8K advanced BASIC interpreter on ROM. Application Functions: Central Processor—Controller/Monitor—Development System.

high-level BASIC programming language and Disc Operating Systems (DOS) software.

It's also important to note that our microcomputers are not home-made training devices. They are production model micro-systems, identical to many you'll encounter in the field. We believe this makes your training a lot more exciting and relevant.



3

The **NTS/SYM-1 Microcomputer (#3)** is a 6502-based CPU-4K bytes ROM (expandable)—1K RAM (expandable) 51 active I/O lines for versatile interfacing disk drives, ASC II keyboards, cassette tape, etc. It is featured in the Master Course in Electronics and Industrial Technology.



From the latest state-of-the-art Video Systems Technology, NTS offers its popular Color TV Servicing program. You build and keep the NTS/HEATH 25-inch (diagonal) Digital Color TV receiver as part of your "hands-on" training. Choose Communications and you'll train on an NTS/HEATH 2-meter FM Transceiver which you also build and keep. Most programs also include state-of-the-art test equipment as well as a digital multimeter.



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# PM ELECTRONICS MONITOR



## Ham band expansion—when?

"A treaty has no meaning at all," a calm voice explained to us over the telephone, "until it has been ratified." We were speaking to James McKinney who is the Federal Communication Commission's Chief of the Private Radio Bureau. We were discussing WARC-79 (the World Amateur Radio Conference which was held in 1979) and what results it has had to date.

WARC-79 allocated three new, worldwide amateur radio bands (sets of frequencies). Many radio amateurs (or hams) expected that it wouldn't be long before they could fire up and begin using these new frequencies. Instead, they've waited three years already and only one of the new bands has been authorized.

Meanwhile, many thousands of amateurs have purchased equipment capable of operating on the new frequencies. The manufacturers, it seems, are much more efficient than the legislators.

What's interesting is to see just how slowly the government moves (some would say, *must* move) in a case such as this.

First, WARC-79 itself presented a pretty "iffy" situation. Many amateurs expected they would lose frequencies, rather than gain them. But when the dust settled, the 10-, 18- and 24-MHz ham bands looked to be a near-reality.

The first "expected" delay came when the WARC nations took half a year to write up their full treaty. The FCC received the treaty in the fall of 1981 and presented it to Congress. The same Congress that quickly passed a multimillion-dollar appropriation to study the issue of the snail darter fish has already waited a year and a half to act on ratifying the WARC treaty.

"I do expect that Congress will act early in the next session," McKinney told us. They were almost ready to discuss it, he said, when they broke the last session.

The American Radio Relay League (ARRL), which claims to represent the United States' amateur population, successfully lobbied the FCC to assign at least the 10-MHz frequencies on a temporary basis. The FCC felt that, in this

instance, it could grant the privileges since the frequencies were slated to be shared—and as 45 other countries had *already* given those frequencies to their ham populations. But the other two bands of frequencies will remain unutilized until the Senate gets its act together.

The ARRL, which is to be commended for getting what it did, puts a brave face on it. "We're happy with progress so far," ARRL's Hal Steinman told us. "but would have liked to have seen it sooner."

In the past, radio amateurs, through their unstinting and unpaid efforts, have been responsible for many worldwide disaster communications—more times than a complete magazine could detail.

And technologically, hams have made contributions to every facet of the radio and TV art. Suffice it to say that we all owe these electronic innovators a large debt.

But what of tomorrow's radio and TV pioneers? It seems appropriate for the United States Senate to act in a much speedier manner than it has demonstrated so far.



**HERO-1**, or *Heath Educational Robot One*, is a futuristic house pet. Building him is a complete course in robotics.

## Here comes HERO-1

Heath has announced a new kit—an electronic robot. HERO 1 (Heath Educational Robot One) incorporates many of the systems found in industry, but you can take HERO home. The 20-inch-tall robot has a computer and sensors to detect light, sound, motion and obstructions. We're building one now; look for his report card soon. **PM**



## The lights—fantastic!

*Lighting a video set is crucial. The set light, above the subject, helps to light up surroundings. The backlights separate subject from background. The*

*key light gives the main "direction" of light—shadow detail. The fill light ensures accurate highlights. Perfect lighting means perfect videotapes.*



Ultra Kings, 2 mg. "tar", 0.3 mg. nicotine; Lights Kings, 9 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method; Filter Kings, 16 mg. "tar", 1.1 mg. nicotine av. per cigarette, FTC Report Dec. '81.

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# THE PM GARAGE



## Good for openers

You can't appreciate an electric garage door opener until you have one. Now I don't have to get out of the car to go through the hassle of opening the door every time I use my car. This new model from Alliance Manufacturing, makers of the Genie automatic door openers for close to 30 years, is dubbed the Trac-Drive GS 840. It features a unique, nylon tape-drive system instead of the usual chain or worm-gear drive method. The new material allows for quieter operation, less maintenance (the nylon is permanently lubricated), and smoother operation since there is no chain slack and the nylon remains flexible in cold and freezing weather.

Other convenience features are in-house pushbutton operation, an outside radio control actuator, built-in safety reverse, a quick-release tether to disengage the drive in an emergency and four

lights that stay on for two minutes, 16 seconds after the door is activated.

It took only two hours to install, even though I had to fabricate my own hangers from angle iron and strap. Genie has a toll-free line for installation problems or questions (800-321-0885).

The new GS 840 that we tested retails for \$229 with one radio control. Write to Alliance Manufacturing Co., Alliance, Ohio 44601.—Joel Breault



Trac-Drive garage door opener has a nylon tape drive system rather than chain or worm-gear.

## Quick circuitry

If you've ever stuck yourself while using the ice pick-style circuit tester, there's a good chance you'll appreciate Schu-Kay's Quickie Circuit Tester. This tool eliminates the possibility of sticking yourself, puncturing upholstery or snagging the dash as you check for current in such wires as power windows, stereo hot leads, trailer wire harnesses and so on.

The fluorescent yellow tool is easy to use. The tip has a hook designed to reach enclosed places or under the dash to grasp wires. A sharp steel rod is enclosed within the tool's housing and is trigger-activated at the handle. A



Hook at end of new tester makes it easy to grab wires when testing for continuity.

5-foot ground wire with 3/4-in. clamp provides room to find a suitable ground.

After grounding, all you do is hook the test wire, pull the trigger to push the steel rod into the wire and the light in the handle will glow if the lead is hot.

The retail price is \$12.50 including shipping. Contact Schu-Kay Inc., Box 19343, Cincinnati, Ohio 45219.—Joel Breault

## Mirrorized goggles

If you're tired of the usual goggle lenses, look at these new mirrorized eye protectors from MXL Products.

The goggle housings are available in red, blue, yellow or black. Lens choices are clear, smoke, amber and the new mirrorized model. The lenses are treated to be fog-free on the inside and scratch-resistant. The goggle housing has built-in vents and are large enough to fit over most eyeglasses.

MXL Products are at motorcycle dealerships or ski shops. The price is \$21 for the complete goggles. Replacement lenses cost \$7 for the mirrored jobbers and \$5 for the others.

To obtain an MXL Products catalog of



Goggles from MXL are scratch-resistant.

riding gloves, goggles and the like, send \$2 to National Hydron Inc., 1764 Rohrerstown Rd., Lancaster, Pa. 17601.—Joel Breault

## Big foot

If you own a motorcycle, you're probably familiar with that sinking feeling that comes from watching your bike fall over after you park it on hot tarmac or too-soft sand. You can reduce the chances of your bike's toppling over by increasing the surface area of the kickstand. The All-Safe Boot does just that.



Plastic boot increases contact patch of a kickstand to keep bike from tipping.

The flexible rubber cover merely slips onto your kickstand to increase the size of its footprint. Although the product wouldn't fit onto the kickstand of my Yamaha Vision, it did work well on one of my dirt bikes. It will also work on bicycle kickstands.

The boot costs \$4 from Clyde T. Johnson Assoc., Drawer 100, Escanabe, Mich. 49829.—Joel Breault



# DODGE RAM MISER



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<b>Price</b>	<b>\$5989*</b>	<b>\$6321*</b>	<b>\$6343*</b>
GVW rating (lbs.)	4800	3740	3443
Payload (lbs.)	1465	1210	1000
Galvanized steel	310 sq. ft.	50 sq. ft.	265 sq. ft.
Std. Engine (liters)/Cylinder	3.7L/6	2.0L/4	1.9L/4
Fuel tank (gal.)	20	15.2	13.2
Est. hwy./EPA est. mpg	30 [21]**	36 [26]**	39 [27]**
Range†	600 [320]**	547 [312]**	515 [370]**
Box—Inside length	76.9"	72.2"	73.1"
Inside width	70.0"	54.3"	59.1"
Width between wheelhouse	51.0"	40.4"	39.9"
Cubic capacity	61 cu. ft.	37 cu. ft.	35 cu. ft.
4-speed manual overdrive transmission	Standard	Not available	Not available

## Compare Miser's Std. Engine To Ford's And Chevy's Largest Engines

Engine (liters)/Cylinder	3.7L/6	2.3L/4	2.8L/6
Additional Cost**	No Charge	\$112	\$490
Max. torque (lbs. ft.)	175	124	145
Est. hwy./EPA est. mpg	30 [21]**	33 [25]**	34 [23]**

\*Base sticker price. Title, taxes, dest. charges extra. Comparisons apply to Ford Ranger, not Ford Ranger S.  
 \*\*Use EPA est. mpg number for comparison. Your mileage range may vary depending on speed, distance and weather. Actual hwy. mileage and range probably less. CA est. lower Range = EPA est. a tank cap.  
 †Greater range is based solely on fuel tank capacity. \*\*Based on comparison of manufacturer's suggested retail prices. Chevy S-10 includes required power steering.

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Best of all, Ram Miser's a Ram Tough Dodge, built to last with the most rust-fighting galvanized steel in critical areas. There may never be a better time

than now to buy or lease a new Ram pickup at your Dodge dealer: we're building our trucks like we never did before.

Walt Garrison,  
Pro football and  
rodeo star, Dodge  
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**"When you've got a load to haul, you need a truck, not a toy. Get a Dodge and put your money where the muscle is."**



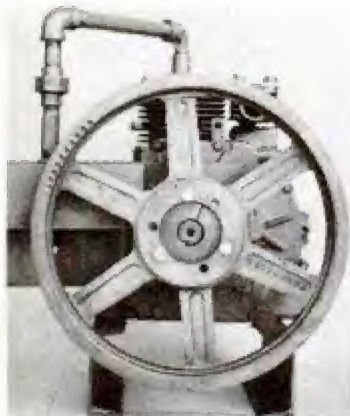
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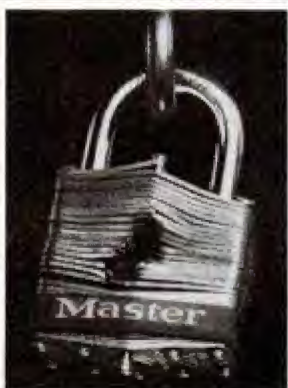
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Have you priced furniture lately? Whew! It's not sticker shock—it's sofa shock! Even worse, it's almost impossible to find real quality and craftsmanship at *any* price. That's why so many people are looking for fine old furniture, and then refinishing with Formby's® Furniture Refinisher.

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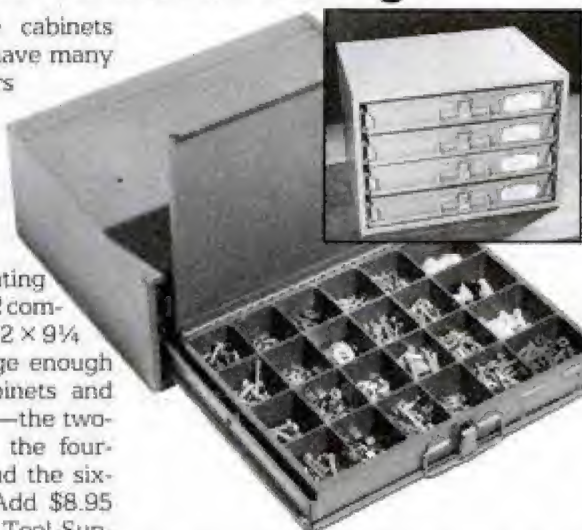
# THE PM WORKBENCH



## Well-organized fastener storage

The new fastener storage cabinets from Reid Tool Supply Co. have many features that do-it-yourselfers and pros will appreciate. Made from cold-rolled steel and finished with acid-resistant enamel, this system has removable drawers with latching lids and handles.

Divider trays for separating items come with 24, 16 and 12 compartments. Without trays, the  $2 \times 9 \frac{1}{4} \times 13 \frac{1}{8}$ -in. drawers are large enough for storing hand tools. Cabinets and drawers are sold separately—the two-drawer cabinet for \$25.95, the four-drawer model for \$34.95 and the six-drawer model for \$46.95. Add \$8.95 for each drawer. From Reid Tool Supply Co., 2265 Black Creek Rd., Muskegon, Mich. 49444.—H.W.



Heavy-duty lids and latches on drawers make the box ideal for on-the-job use.

## Two worthwhile booklets

A couple of good and useful little books recently crossed my desk and I believe PM's active readers will be interested in both. Each contains excellent information written in clear, concise form, and the price is right—one costs just 50 cents and the other is free.

*The Wallbanger Pocket Guide* is a 20-page, step-by-step illustrated booklet covering sidewall application of cedar shakes and shingles. The book gives information about the various shakes and shingles available, tools required for application, advice on handy shortcuts and straightforward how-to that makes the task a relatively easy one. A good value for 50 cents from the Red Cedar Shingle & Hand-split Shake Bureau, Suite 275-PM, 515 116th Ave. N.E., Bellevue, Wash. 98004, this guide shows a do-it-yourselfer how to save 60 percent of normal costs for shake and shingle siding.

*Operator's Safety Manual* is free from the chain-saw manufacturer Husqvarna, 224 Thorndale Ave., PM-383, Bensenville, Ill. 60106. The booklet covers basic chain-saw safety tips and specifics for various work techniques. Topics include a safety checklist, personal safety equipment, a chart showing saw parts, and tips on start-

ing, maintenance, felling, limbing and bucking. If your local Husqvarna dealer doesn't have any booklets in stock, write to the manufacturer.—H.W.

## Three-in-one scissors

Don't let the word "scissors" fool you—the tool shown here can actually cut a quarter in two. Although they look like an ordinary pair of scissors, Omni scissors can be used to cut tin, heavy plastics, nylon and leather. The scissors have a breakaway feature that adds to their versatility. Separated from its mate, one blade serves as an all-purpose utility knife, while the oth-



With breakaway feature built in, Omni scissors serve as three tools in one.

er, serrated blade can be used as a mini-saw.

Priced at \$31.90 postpaid, the scissors come with a one-year limited warranty. Write Omni Scissors, Box 2176-PM, Orange, Calif. 92669.—H.W.

## Palm-size electrical testers

Two hand-size voltage and continuity testers introduced by Triplett Corp., Bluffton, Ohio 45817, feature an internal sensor that protects them against burnout and overload. This new design eliminates the conventional fuse, thus avoiding annoying fuse blowouts.

Model 202 is a good choice for do-it-yourselfers. It has an a.c. voltage range



Snap-in probe and 3-ft. probe lead are convenient for various electrical tests.

of 12, 24, 120 and 240 and a d.c. range of 1.5, 6, 9, 12 and 22.5. The continuity range is 0 to 150,000 ohms (approximately 10,000 ohms at half-scale).

Model 203, for electricians and maintenance pros, has a voltage range of 1.5 to 480 v.a.c. or v.d.c. and a continuity range of 0 to 100,000 ohms (about 7,000 ohms at half-scale).

Model 202 is \$19.50; Model 203, \$24.50, batteries and instructions included. The testers are at home centers and electrical supply houses.—H.W.

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.



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Trim new Ford 4-wheeler seats four in comfort. Split fold-down rear seats add extra versatility, plus up to 64 cu. ft.\* of cargo space.

\*Based on SAE specifications.



V-6 engine standard, a V-6 with power the S-10 Blazer can't match. Extra pull for mud and snow. Big 23-gal. fuel tank.



Flip to 4-wheel drive from the driver's seat with auto-lock hub option. In snow or bad weather, shift to 4WD traction and relax.



Illustration: 4-wheel drive option not available on all models.



# BRONCO II



IT'S A BRAND NEW KICK!!



FORD

FORD DIVISION



Built Ford tough, with husky frame and chassis, tested Twin-Traction Beam front suspension. Proven manual or optional auto-lock hubs.



New sporty trim size makes driving and parking easy. Roomy, comfortable interior. Plus independent front suspension for controlled ride.



Perfect size for 4-wheeling—maneuverable Bronco II turns in less space than the S-10 Blazer or Jeep CJ's. Try it... for a brand-new kick!



Get it together—Buckle up



# SATURN V

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## STATE-OF-THE-ART

---



**Free** movies, sports and special events with the Saturn-V deep fringe microwave receiver for homeowners outside the service area of local over-the-air pay TV stations (i.e. HBO, Showtime). The Saturn-V is a high technology microwave downconverter featuring State-of-the-Art electronics for general microwave usage. Receiving range is 65 miles line-of-sight of a local transmitting tower.

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#### Design/Performance features:

- Gain 40 db • Frequency 2-2.5 Ghz • Tuning-Channels 2-6 • 20 inch Parabolic antenna • Power supply • 60 ft. cable, cable adapters, brackets and hardware included • Illustrated instructions • full 6 month warranty

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*Note: Saturn V will not receive any signal sent from microwave link towers to cable companies. This signal is a higher frequency Saturn V will not decode or unscramble.*

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**AMERICA'S NEWEST AND MOST POWERFUL BIPOLAR IONIZING-PRECIPITATOR CLEANS YOUR AIR OF HARMFUL, IRRITATING POLLUTANTS BETTER THAN ANY OTHER ROOM IONIZER.**

**IF YOU WANT CLEAN FRESH AIR OR YOU'VE UNPLUGGED YOUR POPULAR FILTER-FAN UNIT BECAUSE IT DOESN'T WORK THEN READ THIS...**

Is your indoor air fresh, clean and alive? Indoor air pollution is becoming a national health hazard. Energy efficient airtight buildings are stifled with stale polluted air which includes smoke, dust, pollen, viruses, and bacteria. Most of these pollutants are so small (under 5 microns) that they are not effectively removed by common small filter-fan units. Scientific tests show that these noisy toy-like devices which emit chemical "citrus" odors are no match for high-powered ionizers in thoroughly cleaning indoor air.

## ANOTHER IMPORTANT DIFFERENCE

You know how fresh and vibrant the air feels right after a rain storm, in the mountains, or near a waterfall. That clean, alive fresh air is rich in something important that is greatly depleted in our urban and indoor air. That missing element is negative ions, nature's own air cleaners. *Scientists claim that these amazing active ions are of great benefit to you and can actually make you feel alive, revitalized and alert while often relieving depression, headaches and allergies and even make plants grow better. In addition, hospitals use ionizers in burn units to destroy bacteria and reduce pain.*

Filter fan units do not emit negative ions. The COLLECTOR, by Zestron, creates trillions of these beneficial ions every second, while giving you the best performance, value and technology in air cleaning.

## THE ZESTRON BREAKTHROUGH!

Most ionizers clean your air but leave an untidy deposit of pollutants on room and furniture surfaces near the ionizer. The COLLECTOR by Zestron takes ion technology a giant step forward by giving you superpowered ion output while depositing pollutants from your air on the collector panel. This easy to clean panel features a scientifically formulated surface that electrostatically attracts the vast majority of air-born pollutants to it rather than to the floor or walls near the ionizer. Other bipolar ionizers with porous collecting surfaces that absorb odors and unsightly grime are almost impossible to clean.

## AMAZING DEMONSTRATION!

Unplug your COLLECTOR, place the ionizer unit and an ash tray on top of the panel. Place a lit cigarette in the ash tray and watch the smoke rise into the air. Now plug it in, and amaze yourself and friends as the smoke barely rises above the ash tray and then nose-dives onto the collector panel before it can enter the room air. This is accomplished entirely electronically with no moving parts! The COLLECTOR by Zestron is the only ionizer on the market that cleans the air powerfully enough to accomplish this test.

## ADJUSTABLE OUTPUT

Some people prefer fewer ions at night. The COLLECTOR is the only adjustable bipolar ionizer that allows you to set the ion level to your personal preference.

## THOUSANDS OF SATISFIED USERS

Don't you, your family and friends deserve the healthy clean fresh air that Zestron ionizers have brought to thousands of satisfied users? Users write: "I simply can not believe how much better I feel physically" Dr. E.K., DDS—MA; "I smoke heavily and it has cleared the air as advertised" G.P.—WA; "I haven't taken the top off my nasal decongestant spray since using your product. I was previously a chronic user." G.S.—SD.

When you use your COLLECTOR, you'll quickly feel the difference it makes and smell the freshness in your air. You'll actually see the elimination of smoke and dust in your air!

## SILICON VALLEY TECHNOLOGY

The COLLECTOR, incorporating years of high reliability design experience, is built with quality parts in the heart of Silicon Valley, USA, to give you years of trouble free service. The COLLECTOR operates anywhere in your home or office for pennies a month and has nothing to wear-out or replace.

## SUPERPOWER OUTPUT

The COLLECTOR by Zestron is the only bipolar collecting ionizer with superpower output. The thoroughness and speed of air cleaning increases with more ion output, and Zestron ionizers give you the highest output (without detectable ozone). Check the comparison chart below. Don't buy any ionizer not stating output using the industry standard of ions/cc/sec. at one meter.

IONIZER	ADVERTISED OUTPUT (1 m.) ions/cc/sec.	COLLECTOR
The COLLECTOR by Zestron	1,200,000	YES
JSA Bubble	???	YES
Aspen	???	YES
Orbit	???	YES
AirCarell	236,000	YES
Ion Fountain	540,000	NO
Ion Cloud	350,000	NO
Ionosphere	350,000	NO
Modulian	75,000	NO
Ion Breeze	???	NO

## FREE ION DETECTOR

A FREE remote ion detector comes with each ZESTRON to verify and compare output. When you place the detector next to a ZESTRON and a competitive unit, you will see greatly reduced or no output from the competitive unit!

## SATISFACTION GUARANTEED

Order a COLLECTOR now and try it in your home or office risk free for 30 days. If for any reason you are not satisfied, return the unit for a full refund including return postage. The COLLECTOR has a full one year warranty on both parts and labor excluding abuse.

## ADDITIONAL DEALERSHIPS AVAILABLE

Reorders are pouring in, customers write: "We are enjoying the results of the first one and are ordering two more" Dr. J.B., M.C.—CA; "I'm a distributor for three other ion companies, and have to say I am extremely, extremely impressed!" T.N.—CA.

ZESTRON, the leader in ion technology, has created a unique DEALERSHIP PROGRAM. Call or write for details on this RISK FREE OPPORTUNITY.

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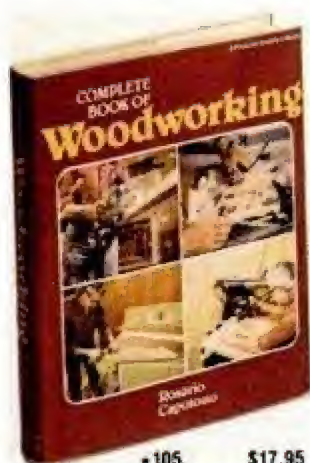
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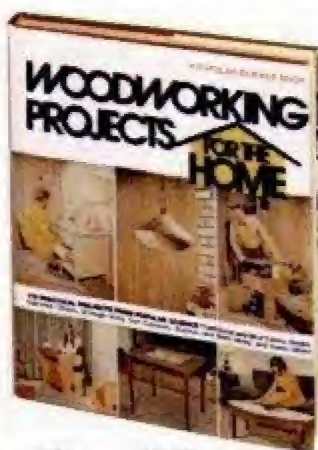
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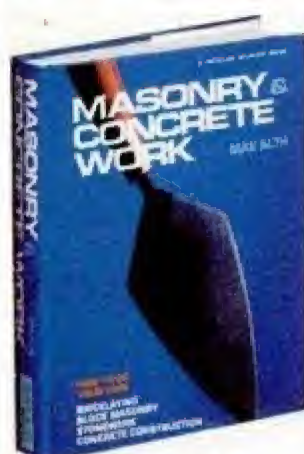
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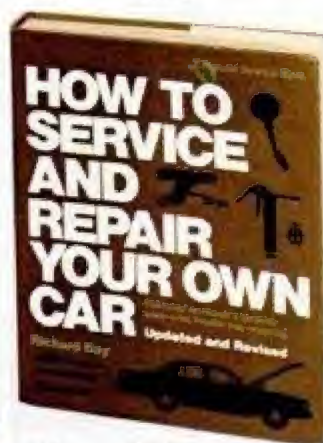
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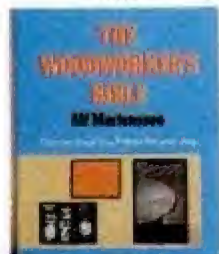
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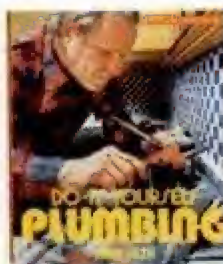
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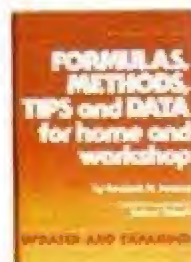
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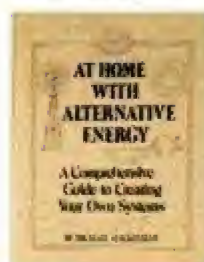
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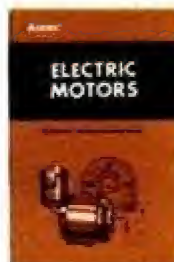
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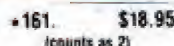
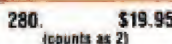
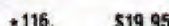
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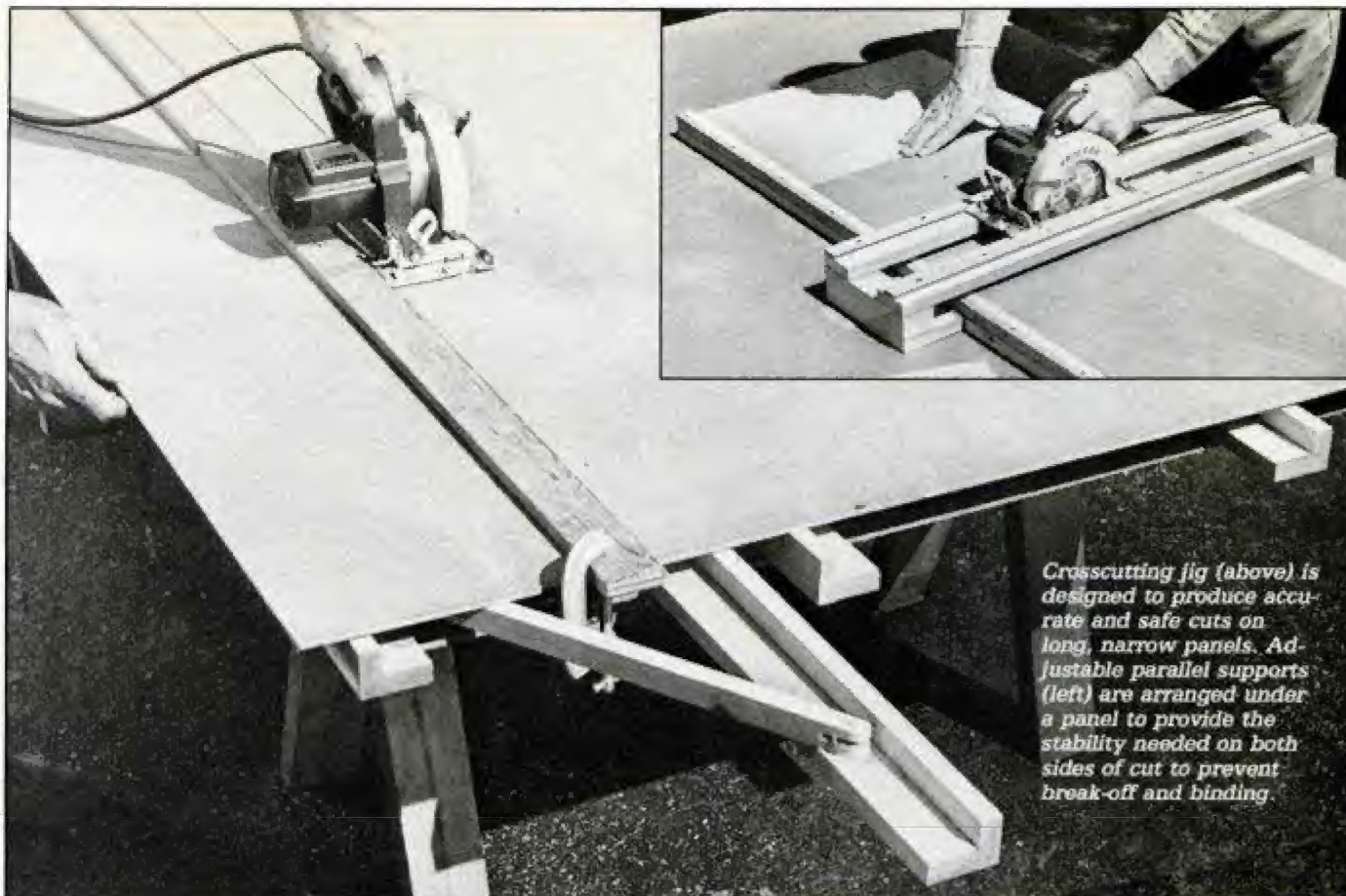
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*Crosscutting jig (above) is designed to produce accurate and safe cuts on long, narrow panels. Adjustable parallel supports (left) are arranged under a panel to provide the stability needed on both sides of cut to prevent break-off and binding.*

PM photos: Rosario Capotosto

# 2 Plywood-Cutting Jigs You Can Make

BY GEORGE OBRADOVICH

**M**aking the initial rip in a 4×8 plywood sheet is tricky business for many home woodworkers, even those with table or radial-arm saws—especially when shop space is limited. The size and weight of large sheets often make control clumsy. Crosscutting long, narrow panels can be a scary proposition because most bench saws aren't large enough to support work well and the danger of kickback is high. Here are two jigs designed for coping with the problems of cutting large panels by using a portable circular saw:

## Crosscutting jig

This jig was built for working with panels of any length up to  $\frac{3}{4}$  in. thick and up to 26 in. wide. By altering the width of the base and the length of the saw-guide assembly, you can build the jig to handle wider panels.

Start by cutting the base from a full sheet of particleboard. Attach the pine lattice fence to the mill edge so it is perpendicular. (Please turn to page 66)

## CROSSCUTTING JIG



*Mark line-of-cut 30 in. from the right end of the base, using a carpenter's square.*



*Lay your square on the cutting mark and pass saw along the guide, adjusting guide position until blade touches square for its length. Then, fasten guide to base.*



*Use the saw's shoe width to set space between shoe guides. Pass saw between the guides and eliminate any binding or play before fastening the guide strips.*



*Tape measures on fence save you the trouble of making layout marks on work.*



## PLYWOOD-CUTTING JIGS

(Continued from page 65)

fectly straight. Don't glue the fence in place; you may wish to replace it as the jig wears. Mark the base with a pencil line to lay out the line-of-cut.

Construct the saw-guide assembly next. Attach spacer blocks at either end of the saw-guide base to create a 1½-in. clearance between the top of the saw-guide assembly base and the bottom of the shoe base supports. Use your saw's base as a spacer for the shoe guides.

Slip the main base into the saw guide assembly and line up the parts to approximate their final positions. Follow the dimensions in the drawing labeled *bottom detail*. Square up the saw-guide assembly with your saw in place, making adjustments until the saw blade follows the line-of-cut already laid out on the base. Then, clamp the main base and the saw-guide assembly base together, flip the jig over and fasten the two components with screws through the bottom of the saw-guide assembly.

Finally, trim two cloth tape measures for mounting on the fence. Cut one to 30 in. and glue it to the right of the cutting mark. Trim the second tape to 42 in. and mount it upside down running to the left of the cutting mark.

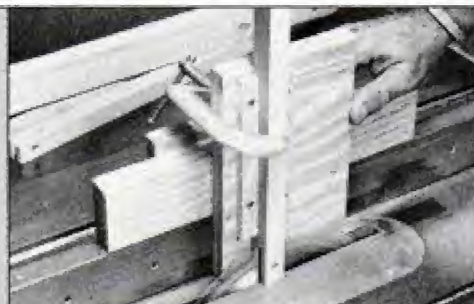
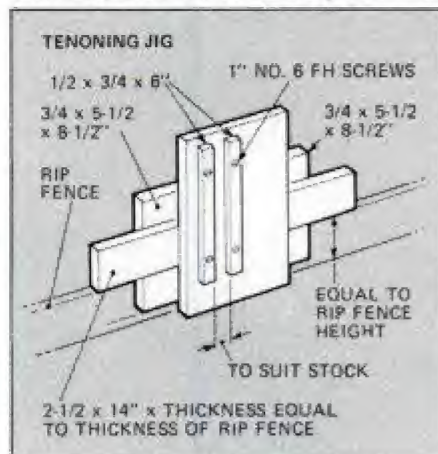
### Adjustable parallel supports

The pivoting connectors on this jig allow you to adjust the distance

between the sides to support any size cutoffs and also permit the units to be folded up for storage. Four units like the one shown in the drawing will make it easier for you to cut 4x8 panels.

Cut the pieces for plates, uprights and connectors from defect-free stock.

### ADJUSTABLE PARALLEL SUPPORTS



*This tenoning jig, built from scrap, rides on the table saw's rip fence and holds the workpiece in a vertical position specifically for cutting a slot in the end.*

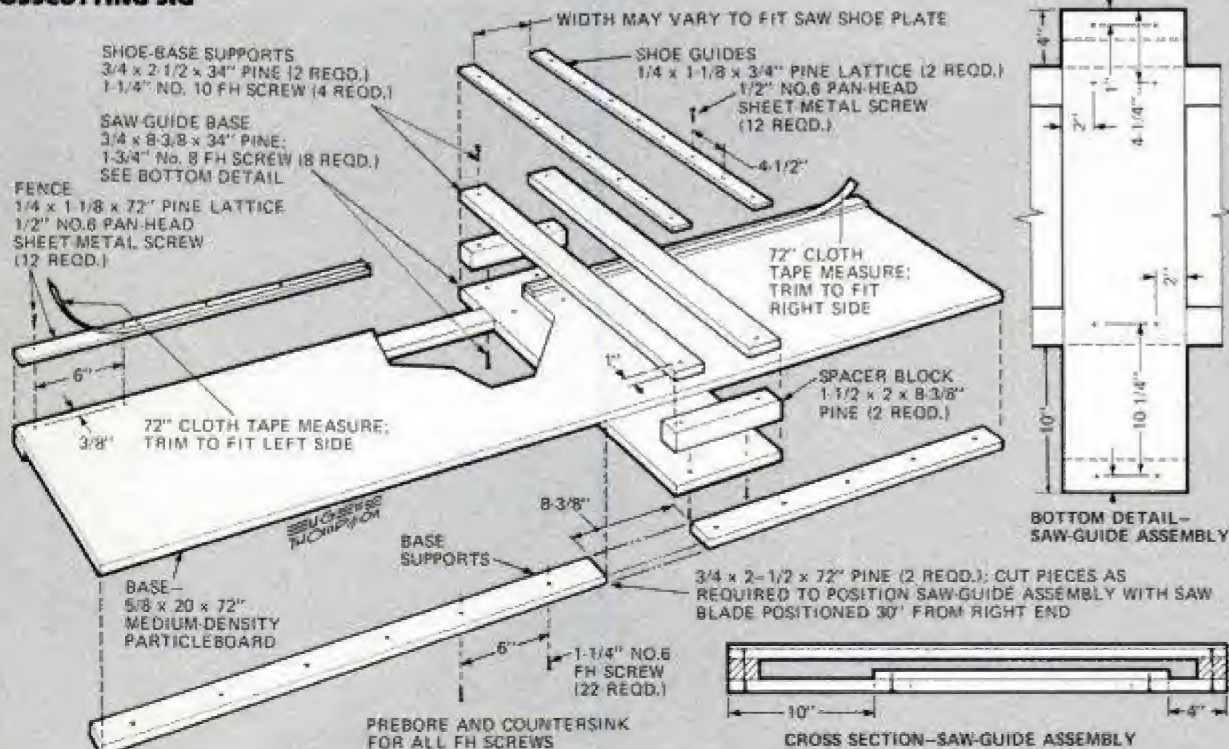


**Crimp one end of dowel pivot pins with pliers and glue them in holes in plates.**



*Fit end of connector over the pivot while slipping a washer into place in the slot.*

### CROSSCUTTING JIG







# When a big one's on the line, better fish Stren.<sup>®</sup>

You had him. But your line couldn't hold him. And you lost your balance as well as your fish. Head for the tackle shop and pick up some Stren, the all-purpose line from DuPont.

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# 23 FOR '83! FORD HITS NEW MPG PICKUP HIGH.



Ford does it again! Sets a new EPA gas mileage rating record for full-size six-cylinder pickups — 23 MPG.



The truck is Ford's fuel-saving FS model — a big, tough pickup with full comfort for three. The engine, Ford's 300 Six. This husky 4.9L powerplant is more than fuel efficient. It's the biggest — and best-selling — Six in any pickup.\*

**MORE '83 NEWS.** New 6.9L pickup diesel, the most powerful diesel ever in heavy-duty F-250/350 pickups and 4x4's. Plus the 7.5L gas engine in pickups over 8,500 lbs. GVWR. See what's new in pickups — at your Ford Dealer!

\*Based on R.L. Polk & Co. registrations, May 1982.

**33** EST  
HWY

**(23)** EPA  
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MPG

FS model with 4-speed over-drive. Use for comparison. Your mileage may differ depending on speed, distance and weather. Actual highway mileage lower. FS not available in California.

Get it together — Buckle up.

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# AMERICA'S TRUCK

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FORD  
TOUGH**



## PLYWOOD-CUTTING JIGS

(Continued from page 66)

up in the final assembly. After the holes have been bored, ream the holes in the connectors so they'll pivot freely on the dowel pins.

Any of several methods can be used for cutting slots in the ends of the connectors, but if you plan to use a table saw, you should build a tenoning jig like the one shown on page 72. After slots are cut, round the ends of the connectors.

Fasten the uprights to the plates with screws and wood glue. Cut dowel pins, crimp the ends and glue the pins into the plates. Slip the connectors with washers inserted in the end slots over

the pivot pins and check that they pivot freely.

To complete the job, bore pilot holes in the dowel sides and insert nails to serve as retainer pins. **PM**



Bore a  $\frac{3}{8}$ -in. hole through the pivot and into side of upright. Insert a 2-in. finish nail to serve as a retainer pin.



Setup for ripping a  $\frac{1}{2}$ -width from full panel; note clearance left for saw blade.



A setup such as that shown here is used to facilitate the making of narrow cutoffs.

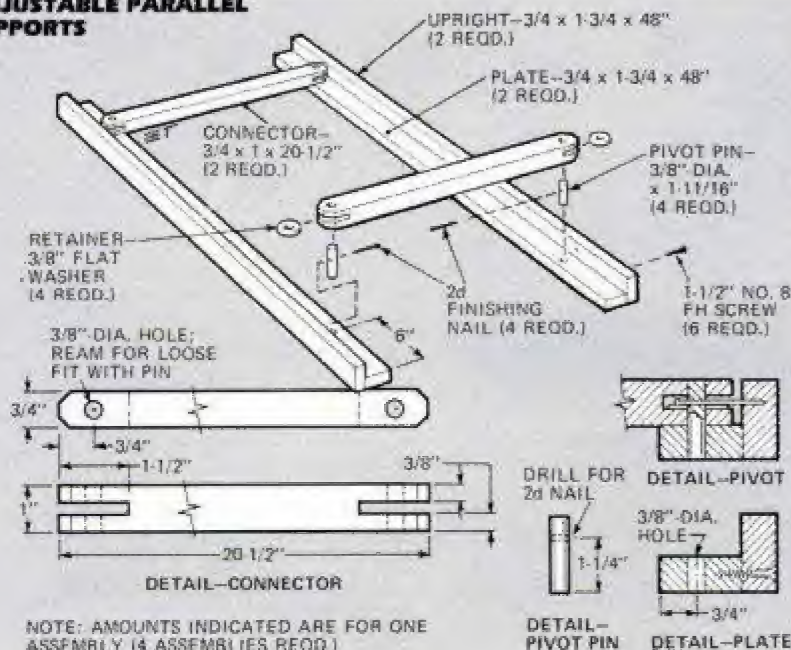


Four units are arranged like this to make two cuts meeting in an inside corner.



Leave space between units along line-of-cut to provide clearance for saw blade.

### ADJUSTABLE PARALLEL SUPPORTS



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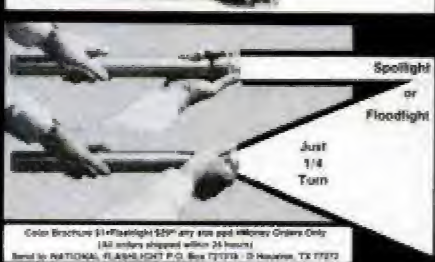
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## PM OWNERS REPORT.

BY MICHAEL LAMM WEST COAST EDITOR

# BUICK SKYHAWK

*"Needs a lot of highway to  
pass other cars at speed."*

—IOWA AUDITOR

*"Turns on a dime  
and takes about \$6  
to fill it up."*

—TEXAS RANCHER



*"THE PUSHROD 1.8 IS A WEAK ENGINE,  
AND THE AUTOMATIC SHIFTER  
IS VERY STIFF."*

—COLORADO ELECTRONICS  
TECHNICIAN

*"Very sporty. I enjoy  
driving a car with this  
good quality inside and out."*

—MICHIGAN MACHINIST

*"The seatbelts are  
extremely uncomfortable  
on the neck  
and shoulders."*

PM photos: Bill Ashe

Owners love the handling and fuel consumption, but they demand more power.

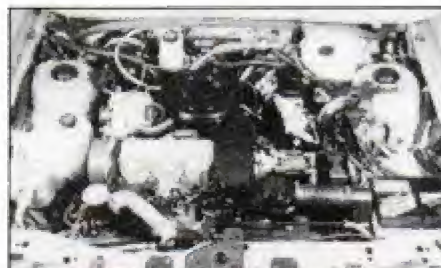
**B**uick got its J-car a little late, but the division's been making up for lost time with improvements and features.

Buick began marketing the Skyhawk last March. This is basically the same GM front-wheel-drive J-car that Chevrolet, Pontiac and Cadillac have been offering since May 1981 as the Cavalier, J2000 and Cimarron, respectively. Oldsmobile announced its version, the Firenza, concurrently with Buick.

Over the past year, Buick has added the Skyhawk T-type plus a new wagon body style and a five-speed manual transaxle. The original 1.8-liter pushrod Four has been dropped in favor of the Opel-designed, Brazilian-built overhead-cam engine, also displacing 1.8



*Buick did a good job on the interior. Most found it comfortable and well laid out.*



*No. 1 complaint was lack of power. The most requested change? A better motor.*

liters. This newer unit is more powerful and fuel-efficient than its predecessor. It uses an aluminum head and throttle-body fuel injection.

The Chevrolet-built, 2.0-liter pushrod engine, also with TBI, is now standard in all Custom (base) and Limited Skyhawks. The heavier 2.0 rates two more horses than the ohc 1.8 (86 versus 84 hp), but gives up a couple of foot-pounds of torque (100 at 3,700 com-

## A NATIONWIDE SURVEY BASED ON 1,130,449 OWNER-DRIVEN MILES

pared with 102 at 2,800 rpm).

At the time of our survey, the wagon and five-speed transaxle weren't yet offered, and the ohc 1.8 remained an option. Today, the ohc 1.8 and five-speed are standard in the T-type and

*(Please turn to page 75)*



# How Havoline Supreme can help you get the most out of your car.



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And its multigrade rating offers the convenience of all-year-round, wide-temperature range protection.

## **Havoline gives you proven protection.**

The final test of a motor oil comes under actual driving conditions. Havoline Supreme has proven it delivers the kind of protection needed in

tough, high-speed state trooper cars and severe stop-and-go driving in New York City taxis.



## **Havoline helps save gasoline.**

Fuel economy tests proved it. Compared to a conventional motor oil, Havoline

**3 9 8 2 4 2**

Supreme, with its special friction-fighting additive, helps save gasoline.

## **Havoline is diesel tested.**

If you own a diesel, we have good news. Havoline 10W-30 has the API-SF/CC rating required by most engines like yours. And it's been proven in punishing diesel-powered taxis.



## **Listen to an expert.**

Top Indy 500 driver Tom Sneva calls

Havoline Supreme a "very sophisticated oil...one that a prudent car owner should use on a regular schedule." Shouldn't you?





Some people get  
all the breaks.



*he lucky-  
it could have b*  
**THERE GOES  
THE GOLD!**  
JOHN

*Can I  
borrow your  
skis?*  
**BILL**

*TOUGH  
BREAK!  
CHAMP!*  
**DOC**  
*What a great  
setting-  
the snow, the  
mountains and  
your leg!*  
**DOC**

**Canadian Club**  
"The Best In The House"



## OWNERS REPORT: SKYHAWK

(Continued from page 72)

optional in other series. Buyers seem to value the Brazilian engine's virtues, though, because 57 percent of the owners in our sampling had ordered it as an option.

For this Owners Report we'd like to break with tradition and change our established format slightly. Instead of categorizing comments, we let 11 representative Skyhawk owners present their opinions with minimal editorial comment from us.

The first remarks come from a 25-year-old account executive at a Minnesota radio station. "I'd owned imports in the past, but one of the main things that motivated me to buy this Skyhawk is that it's built in America. In addition, I was attracted by the car's styling, and when I drove it, it seemed sturdy and well built. I think the 1.8 ohc engine is

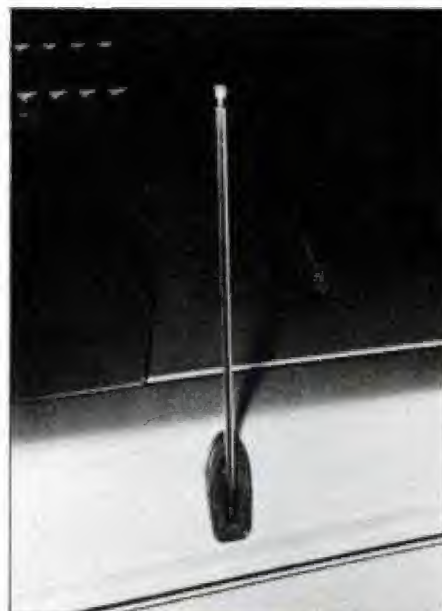
he continues, "although the AM/FM radio went out and had to be replaced. They replaced it while I waited. The dealership is superb, with a clean and efficient service department. The salesman made it very easy for me to buy this car. The sticker said \$9,900, but I ended up paying \$8,500."

A Massachusetts metalworker, age 48: "The oil filter is hard to get at, and the rear defroster isn't hot enough. But I've had no mechanical problems, and workmanship is excellent. It took about 5,000 miles to get the engine to peak performance. I'm now getting 25/35 mpg city/highway with the 1.8 ohc and automatic. I'm very happy with my Skyhawk."

A Texas salesman, age 59: "No road noise, and that's unusual for a small car. Price turned out to be good, especially since the dealer gave me a \$400 rebate. I've owned several Buicks, and I like the Skyhawk's size and comfort, although rear passengers say it's a little cramped."

An Alabama refrigeration servicer, age 25: "Poor quality control. Buick is supposed to be an upmarket GM car, but my Skyhawk came with a windshield leak, malfunctioning speedometer, sticking fuel gauge and squeaky brakes."

Now a Florida realtor, age 63: "We've had Buicks in the family for 55 years, and this is the best one I've owned over a 36-year period. It hasn't given me a moment's trouble. The dealer's excellent, quality is likewise, and the only thing I can find wrong is that the automatic shift lever is too stiff. I'm told this is caused by the linkage to the steering lock mechanism, but so far no one's been able to improve it." [In all, 7.6 percent of our respondents men-



Frenched-in antenna base is an example of the attention to detail in the T-types.

tioned the balky automatic shift lever.]

An employment specialist from Idaho, age 45: "I wanted to get back into an American-made car and liked the looks of the Skyhawk. The dynamics, precision and updated technology impressed me. I found a hungry salesman who really went to a lot of effort to offer me a good deal. I hear GM's J-cars aren't selling too well, and I suppose this had something to do with it."

"I find quality good, but not fantastic. The back seat is great for children or legless adults, but front-seat comfort is very good. I particularly like the styling, tight construction, maneuverability and handling and well-grouped instrument cluster. I don't like the ashtray location;

(Please turn to page 76)



Convenience items such as this coin box abound on upscale Skyhawks, T-types.

great. Quality and workmanship are excellent—everything fits, no squeaks so far. Comfort, too, rates excellent up front and fair in the rear seat.

"I've had no mechanical problems,"

## SUMMARY OF 1982-83 BUICK SKYHAWK OWNERS REPORTS\*

<b>Total miles driven</b> 1,130,449	<b>Specific likes:</b>	<b>Workmanship opinion:</b>	<b>Dealer service opinion:</b>
<b>Average miles per gallon:</b>	Styling . . . . . 61.3%	Excellent . . . . . 37.0%	Excellent . . . . . 34.4%
Manual four-speed . . . . .	Economy . . . . . 41.2	Good . . . . . 46.3	Good . . . . . 40.0
In town . . . . . 25.7	Handling . . . . . 40.7	Average . . . . . 11.6	Average . . . . . 12.4
On the highway . . . . . 33.0	Comfort . . . . . 32.8	Poor . . . . . 5.1	Poor . . . . . 12.9
Automatic three-speed . . . . .	Ride . . . . . 26.0		
In town . . . . . 24.9	<b>Specific dislikes:</b>	<b>Comfort opinion (front seats):</b>	<b>Number of vehicles owned:</b>
On the highway . . . . . 31.3	No complaints . . . . . 26.3%	Excellent . . . . . 63.9%	This car only . . . . . 44.0%
<b>Transmission choices:</b>	Not enough horsepower . . . . . 12.6	Good . . . . . 31.5	Two cars . . . . . 40.7
Automatic three-speed . . . . . 80.1%	Quality of materials . . . . . 9.6	Average . . . . . 3.2	Three cars . . . . . 10.2
Manual four-speed . . . . . 19.9	Automatic transmission . . . . .	Poor . . . . . 1.4	Four or more cars . . . . . 5.1
<b>Engine choices:</b>	shifter . . . . . 7.6	<b>Comfort opinion (rear seats):</b>	<b>Makes of other cars owned:</b>
1.8-liter overhead-cam . . . . .	Rattles and noises . . . . . 6.6	Excellent . . . . . 30.0%	Buick . . . . . 26.7%
Four . . . . . 57.8%	Mpg lower than . . . . . 6.6	Good . . . . . 47.8	Chevrolet . . . . . 17.5
1.8-liter pushrod Four . . . . . 35.4		Average . . . . . 18.7	Ford . . . . . 16.7
2.0-liter pushrod Four . . . . . 6.8		Poor . . . . . 3.4	Oldsmobile . . . . . 12.5
<b>Body style:</b>	<b>What changes would you like?</b>	<b>Had any mechanical trouble?</b>	Pontiac . . . . . 10.0
Two-door sedan . . . . . 57.5%	More powerful engine . . . . . 18.4%	No . . . . . 58.1%	Dodge . . . . . 10.0
Four-door sedan . . . . . 42.5	No changes . . . . . 17.8	Yes . . . . . 41.9	
<b>Why did you choose this car?</b>	Better materials . . . . . 10.3	<b>What type of trouble?</b>	<b>Age distribution of owners:</b>
Styling . . . . . 61.1%	Different seat shape . . . . . 6.9	Electrical . . . . . 15.1%	15-29 years . . . . . 31.9%
Economy . . . . . 37.9	Improved automatic . . . . . 6.6	Oil leaks . . . . . 12.8	30-49 years . . . . . 35.3
Size . . . . . 24.1		Air conditioner . . . . . 11.6	50-plus . . . . . 32.8
Made in America . . . . . 12.8	<b>How much did you pay?</b>	Induction system . . . . . 10.5	<b>Would you buy another Buick?</b>
Front-wheel drive . . . . . 12.8	Average . . . . . \$9,233	Transmission . . . . . 9.3	Yes . . . . . 91.8%
	Range . . . . . \$7,200 to 13,000	<b>Dealer repairs satisfactory?</b>	No . . . . . 8.2
		Yes . . . . . 64.3%	<b>Would you buy another Skyhawk?</b>
		No . . . . . 35.7	Yes . . . . . 81.9%
			No . . . . . 18.1

\*Percentages might not equal 100% due to rounding or insufficient data.



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Zebco Division Brunswick Corporation  
Box 270, Tulsa, Oklahoma 74101  
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From the folks you fish with



## OWNERS REPORT: SKYHAWK

(Continued from page 75)

it's inconvenient. And the 1.8 ohc engine clatters on cold mornings. The mechanic says there's nothing Buick can do about it. The noise does go away once the engine warms up."

From a California engineer, age 55: "The sport suspension option on my four-door sedan makes handling in mountain driving and on the open highway very good. Steering is so light that power seems a waste. Front and rear head- and legroom are better than in most full-sized cars of five years ago."

"I've gotten to know my dealer quite well," continues this engineer, "because second and high gears in the four-speed transmission had to be changed on my first service checkup. There was also a problem with engine idle and fuel consumption. The computer was fine, but they found a vacuum leak. I'm now averaging 22 mph in town and 32 on the road. I still feel I'm getting equal or better value than most imports in the same class. I paid \$8,000 and would definitely buy another Skyhawk."

A Colorado speech pathologist and university teacher, age 35: "The salesman promised me a full tank of gas when I bought the car, but it never materialized. The automatic transmission leaked when I got the car, and the gasket had to be replaced. Engine seems peppy, and I like the fuel economy. The armrests could be higher, and the transmission shifts back and forth at certain speeds for no apparent reason. I also wish the transmission would stay in passing gear to a higher speed."

A Texas clerk, age 66: "It's a very easy car to handle; like having my own 'body wheels.' The one thing I don't like about it is that the seats block my view diagonally out the back. I can't see behind me except with the rear-view mirror."

A Tennessee sale engineer, age 39: "Handles almost as well as my Corvette. It also gets good mileage and is dependable. I can't think of anything I'd change except perhaps to move the dimmer switch back on the floor. In my opinion, Buick builds one of the most trouble-free cars anywhere. I know this one will deliver 100,000 miles of service without a major repair, and its resale value will remain high."

And finally, from a New York letter carrier, aged 39: "I loved the styling of the Skyhawk. I had a Century before; best car I'd ever owned. I'm 6-1, with long legs, and there's plenty of room for me. When a person buys a new automobile and has no problems, no repairs, no complaints, and it turns out to be a very nice car, what more can he ask?" **PM**

POPULAR MECHANICS • MARCH 1983

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# Radar warning. Hear the difference.

## What Could Be Better Than Unbelievable Range?

By now, you've probably heard some tall sounding stories about how far away the ESCORT® radar warning receiver picks up radar traps. You know, the ones where they talk in miles instead of car lengths. The stories go on to say that ESCORT's superheterodyne receiving circuits provide as much X and K-band warning as you can possibly use, and then some. If you've never used an ESCORT, they may seem pretty far fetched, but most of them are true. Over hills, around corners, and from behind.

## Car 54 Where Are You?

Maximum detection range is wonderful, but it's far from the whole story. In some ways, radar detectors are like smoke alarms; you want to make sure that you don't miss anything, but you don't want a lot of false alarms. ESCORT won't disappoint you. Beyond that, when a smoke alarm sounds off, the most pressing thing on your mind is: Where is the fire? Is it ahead of you, behind you, above you, or below you? In the same room, or at the other end of the house? Your senses can help you find fire, but, on the highway, you can't feel or smell radar. ESCORT is your sixth sense.

## Hearing Is Believing

ESCORT reports its findings straight to your ears in a way no other detector can match. Its vocabulary includes a Geiger-counter-like pulsating rhythm that relates radar intensity in a smooth, natural, and intuitive manner, making it easy to sense the distance to radar. It can tell you if radar is ahead of you, behind you, or even traveling along with you in traffic. ESCORT also speaks different languages for each radar band. Since the two bands behave differently, the distinctive tonal differences eliminate surprises. You'll even be able to tell "beam interrupter," "trigger," or "instant-on" type radars from other signals just by the sounds they make. Ditto for radar burglar alarms and door openers. ESCORT has a lot to say, and we've developed a new way for you to get acquainted quickly.

## Play It, Sam

ESCORT's instruction book contains a wealth of information. Actually, it's the ESCORT user's Bible. But, the quickest way to become fluent in ESCORT's language is to play the Radar Disc on your stereo turntable. You'll hear firsthand how to interpret what ESCORT tells you in a number of situations. We now include this special Disc with every ESCORT so you can take a test drive as soon as you open the box.

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The ESCORT Radar Disc is the latest addition to a long list of standard features. We don't scrimp on anything. Here they are: ■ Patented Digital Signal Processor ■ Different Audio Alerts for X or K Band Radar ■ Varactor-tuned Gunn Oscillator tunes out false alarms ■ Alert Lamp dims photoelectrically after dark ■ 1/64 Second Response Time covers all radar ■ City/Highway Switch filters out distractions ■ Audio Pulse Rate accurately relates radar intensity ■ Fully Adjustable Audio Volume ■ Softly Illuminated Signal Strength Meter ■ L.E.D. Power-On Indicator ■ Sturdy Extruded Aluminum Housing ■ Inconspicuous size (1.5H x 5.25W x 5D) ■ Power Cord Quick-Disconnect from back of unit ■ Convenient Visor Clip or Hook and Loop Mounting ■ Protective Molded Carrying Case ■ Spare Fuse and Alert Lamp Bulb.

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*Playboy:* . . . "ESCORT radar detectors . . . (are) generally acknowledged to be the finest, most sensitive, most uncompromising effort at high technology in the field."

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16 mg "tar," 1.0 mg nicotine av. per cigarette, FTC Report Dec '91





DE LOREAN  
1981-'82

# AUTOMAKERS WHO DARED— AND LOST

Before De Lorean  
there were many others who went bust.

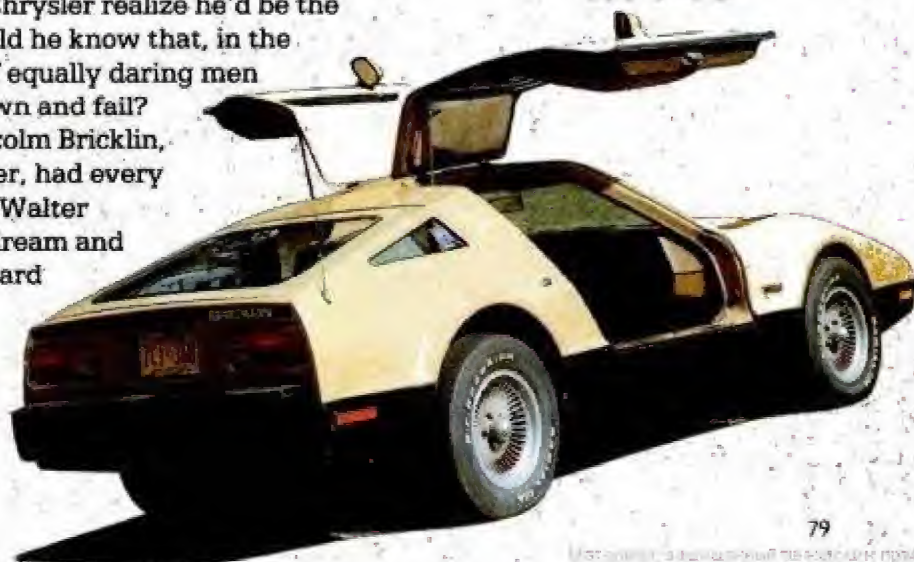
BY MICHAEL LAMM WEST COAST EDITOR

**T**he latest *successful* American mass producer of automobiles was Walter P. Chrysler who, in 1924, daringly launched the car that still bears his name. Did Chrysler realize he'd be the last entrepreneur to succeed? Could he know that, in the intervening 59 years, hundreds of equally daring men would try to create cars of their own and fail?

Some, like John De Lorean, Malcolm Bricklin, Henry J. Kaiser and Preston Tucker, had every bit as much vision and courage as Walter Chrysler. Each dreamed his own dream and went wrong in his own way. It's hard to find parallels.

In some cases, the men's personalities doomed these ventures either from the start or at the bitter end. John De Lorean's flawed ambition makes the

BRICKLIN  
1974-'75







**1930 CADILLAC V16**

Photo credits: Bricklin, Cadillac, Tucker: Henry Austin Clark, Jr.; Auburn, Cord, Duesenberg: A-C/D Museum; Lincoln, Edsel: Ford Motor Co.

most dramatic example. But Bricklin, Tucker, and even millionaire Kaiser simply didn't have the financial resources.

In other cases, the cars didn't live up to expectations. Or the cars turned out to be wrong for the times.

The De Lorean narcotics trial has gotten so much publicity recently that the car seems almost secondary. But the question remains: What would have happened to this automobile in a stronger economy? Would John De Lorean still be in business today?

In my opinion, he would. It's true that the car never fully lived up to all expectations (see *Stirling Moss Road Tests The De Lorean Sports Car*, page 65, June '81). But even so, it had some good points, and I don't believe the ho-hum han-

dling and acceleration, the hard-to-repair, hard-to-clean body, the awkward gullwing doors, or the relatively poor rear visibility necessarily doomed this coupe (see *PM Owners Report: De Lorean*, page 100, May '82).

If annual production could have come closer to the 40,000 cars that John Z. envisioned, he might

have held the price nearer his original \$10,500 than the \$25,000 it became. Through September 1982, only 5,474 De Loreans were sold in this country and that, basically, became the main reason for the car's demise. As so many people have already said, it was simply the wrong car at the wrong time.



**1948 TUCKER**





If it's any consolation to De Lorean, though, he's in very good company as a maker of doomed automobiles. Lots and lots of cars have come along at precisely the wrong moment—good and bad ones alike. And they all cost their makers dearly. While De Lorean managed to lose an estimated \$196.7 million through his daring and misguided judgment, that is by no means a record. Even many successful automakers have lost considerably more than that on nameplates and models that died in the marketplace. Some of these cars killed their

*(Please turn to page 150)*

Some automakers who are solvent today lost a bundle on cars they once manufactured. Cadillac

V16s and V12s cost millions to put into production and General Motors once considered axing the Division. Ford

Motor Co.'s Lincoln Continental Mark II was another financial bomb,

even though the car itself was a wonder of the automotive world in 1956. And Ford's 1958–1960 experience with the Edsel translates into a loss—in 1983 dollars—of almost one billion dollars. Preston Tucker's Torpedo Sedan was an eye-catcher in 1948, but only about 50 were made before he went bust.

The Auburn-Cord-Duesenberg empire, which was dead by 1938, was built up from three separate auto makers by Erret Lobban Cord. The distinctive, "coffin-nosed" front-wheel-drive cars that bore his name are classics today. The

Cord 812 Supercharged Cabriolet is seen at right. The '35 Auburn boat-tailed speedster was a supercharged model with over 100-mph top speed. Fred Duesenberg's cars

—the SJ roadster is seen below—were luxury transportation for movie stars, and Indy winners in '24, '25 and '27.



1935 AUBURN



1956 MARK II



1937 CORD



1958 EDESL

1933 DUESENBERG





A man with a beard and mustache, wearing a camouflage t-shirt and blue jeans, is shown from the waist up, aiming a compound bow. He is holding the bow with his left hand and the string with his right hand. The bow is a high-tech compound bow with a green and black finish. The background is a dense forest with green and brown foliage. The overall tone is serious and focused.

#2,430.00—Spread

# High Tech For Robin Hood

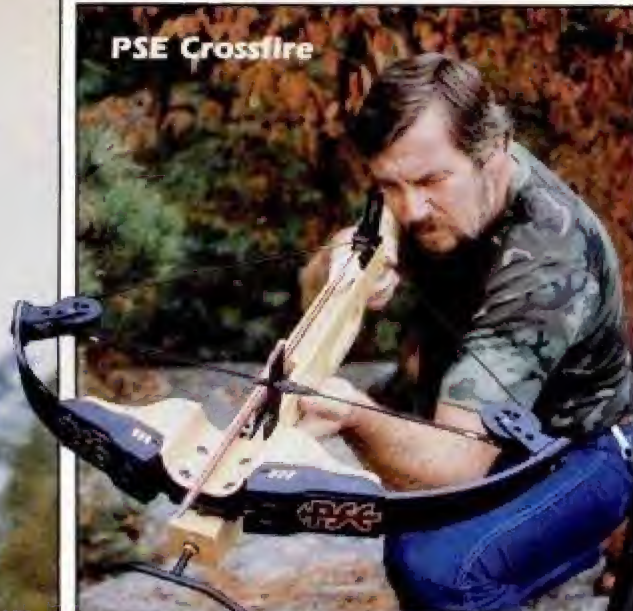
Archers are stringing up new ways to speed arrows to the bull's-eye.

BY CHUCK ADAMS

Martin Overdraw



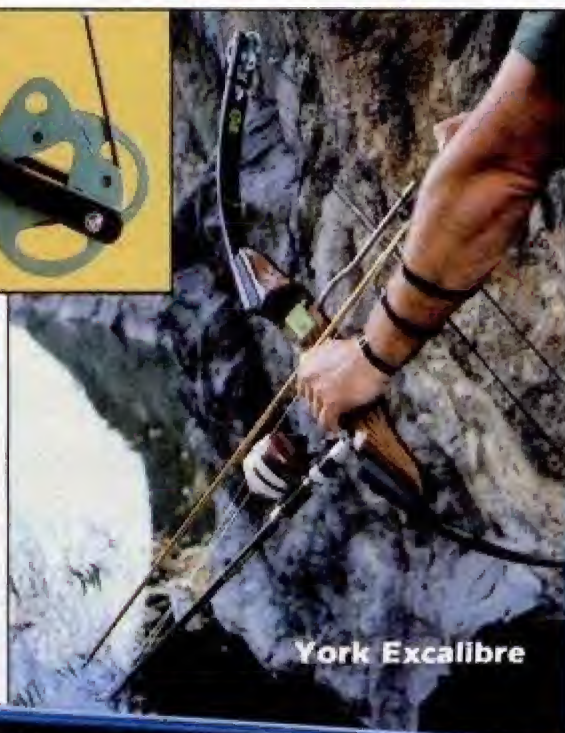
## PSE Crossfire



*Crossfire uses the compound principle in a crossbow with added power. Limbs are of Magnaglass and graphite. Front sight pins (above) adjust for windage, elevation. Bow is from Precision Shooting Equipment in Tucson, Ariz.*



*Martin forward-handle overdraw bow with an Easton stabilizer (on facing page) is a type favored for high-velocity and distance shooting. Compound two-wheeler shown is made by Martin Archery, Walla Walla, Wash.*



## York Excalibre

*York Excalibre compound has interchangeable teardrop-shaped cams (detail inset), is shown mounting Jim*



## Graphite Vector



*Dougherty Fishgetter bow rod, arrow, Zebco 808 reel (above). Bow is from York Archery Div., Woodcraft Equipment, Independence, Mo. Dougherty is in Tulsa, Okla.*

*New PSE Power Cam Graphite Vector I compound bow, by Precision Shooting Equipment, has die-cast magnesium handle, adjustable alloy cams, 50 to 70 pounds peak draw weight. Easton Aluminum, Van Nuys, Calif., combines metal and graphite in the arrow.*

**G**iant improvements have been made in archery equipment during the last 20 years. The hand/eye coordination, precise shooting techniques and intense mental concentration necessary for placing an arrow directly on target haven't changed one whit over the centuries. But modern materials, technology and renewed interest in high-performance bows, arrows and shooting accessories have raised the sport to new levels of precision.

The most significant innovations were the creation and perfection of the compound bow, the introduction of rigidly uniform and accurate high-strength aluminum arrows, and the design of dependable archery range-finders. Today, manufacturers are perfecting their developments to produce maximum shooting enjoyment.

## Bows

The mechanical compound bow has been supplanting recurve bows, longbows and similar one-piece designs since its commercial introduction in 1968. The compound has passed through many stages of improvement during the past 15 years.

The most popular hunting and target bows today are the "two-wheel" compounds with sleek aluminum or magnesium handle risers and stubby, maple-and-fiberglass laminated limbs.

Such bows are quieter, faster and more dependable than the heavier, bulkier four-wheel and six-wheel compounds which were popular a few years back, and tend to produce better accuracy for both the expert and the beginning archer.

The best two-wheel compounds characteristically have handle risers with interchangeable grip shapes to fit just about every hand and shoot-  
(Please turn to page 139)



*Rangin' Measuring System's Bowhunting LR-80 and Eagle Eye 50 aid accuracy.*



\$2,791.00—Spread



# Corvette

PM DRIVES THE '83 AND REMEMBERS THE VINTAGE VETTES.

BY TONY ASSENZA AUTO EDITOR

**C**orvette. Since 1953 it has been America's one and only true sports car. For all its faults, and through its many iterations of body styles and engine displacements, it has been the central love object of a hard-core group of Corvette fanatics. Real fanatics. The kind who can tell you, from memory, every change made since '53, who can tell you the part numbers of a revised shift linkage bracket or a through-bolt or the name of the guy running the paint booth the day the car first came off the line. Serious fanatics. They are a brotherhood unto themselves who for three decades have resisted the temptations of RX-7s, Z-cars and the swarms of British and German sports cars and have remained faithful to the one true and pure American sports car.

An indication of this addiction is the fact that

Corvette registrations exceed the total number of Corvettes ever produced. They're so desirable that they're stolen, chopped up, sold in pieces by thieves, rebuilt by the faithful and sold again. They multiply, sort of an automotive mitosis.

From the Vette junkies' point of view, it is clear that Chevrolet doesn't even own the car. Chevrolet Motor Div. is simply the design and manufacturing arm of this fiberglass-crazed group of Corvette berserkos. They own the car, which makes it really tough when you're in charge of redesigning it. I mean, it goes way beyond a design and engineering job, doesn't it? You have to live up to a legend. Do you mess with it a lot and maybe lose the identity altogether? It's tough enough to design any car without the added burden of having to meet al-



## 1973-82

Emissions and fuel economy killed horsepower and the Vette became a boulevard cruiser for upwardly mobile secretaries. Only collector's item is '78 fastback, especially the Indy Pace Car replica with the 225-hp, L-82 small-block.

## 1983

All-new coupe is smaller, lighter, faster, smoother . . . and handles like an IMSA racer. With a fuel-injected 350 V8, its performance approaches Corvettes of the '60s, but is much more refined. It's the best Vette yet.



PM art: Jeff Mangiat





### 1953-55

Early Vettes are more "personal car" than "sports car." Only 4,640 were sold in three years. Most sporting Chevy's lackluster Blue Flame Six and the Powerglide automatic.



### 1956-62

Classic Corvettes: The ultimate collector's model is a fuel-injected, 283-hp '57 model. It's sleek, speedy and terrific. The later cars are even faster—up to 360 hp from the famous 327 V8—but not as classically pretty.

### 1968-72

Longer, lower, heavier: Mako shark-inspired Vette could be ordered with 365 hp from a 454 big-block or 330 hp from a 350 LT-1 small-block up to '72 . . . the last American muscle car.

### 1963-67

Sting Ray, probably the '60's best street GT, has striking styling, all independent suspension, four-wheel disc brakes (after '65), does 150 mph from 435 hp, 427 cu. in. by '67.



manjiat



most unreal  
have your n-  
you mess it

they turn away in groves, and what happened to  
Porsche with the 924, but they're liable to come to  
your house and break up your lawn furniture. Ser-  
ious fanatics.

### Keepers of the flame

The two men whose lawn furniture was at stake here are Jerry Palmer, chief stylist at Chevy's Studio Three, and Dave McLellan, chief engineer. They were responsible for looking at the blank sheet of paper in 1978 and redoing the car from scratch. They are the keepers of the flame and the ones most likely to get burned by it if the car didn't quite meet those expectations.

They started out with H-points. That's engineer talk for hip points on an imaginary man-in-space. They knew the H-point for the old Vette and didn't like it. They moved it back about 3 inches and slightly down. This gave the man-in-space more head- and legroom. From that, they were able to figure out things like line-of-sight, hood and fender height, interior dimensions and a host of other numbers.

What they ended up with was a lower profile and cleaner line. Gone is the feeling of the old Corvette where you were way down there someplace, craning your neck to peer out between huge, hulking fenders and needing to sit up to find the nose lost some-

6917.00---Spread

the horizon. In almost every interior di-  
the new car is larger than the old one.

exterior is smaller. The car lost 1.8 inches from its wheelbase, 8.8 inches in length and 1.4 inches in height. The only exterior dimension which increased was the width. It went up two inches, from 69 inches to 71 inches, and that translates directly into more shoulder and hip room.

Some other dimensions are pretty startling and demonstrate how different the new car is from the old. Windshield slope angle went from 57.0° to a very fast 64.7°, a figure which Chevy claims is the fastest of any windshield around. Another interesting statistic for you trivia fans is the total windshield glass area. This was bumped from 793.5 sq. in. to a massive 1,350.4 sq. in.. Welcome to the wide open spaces.

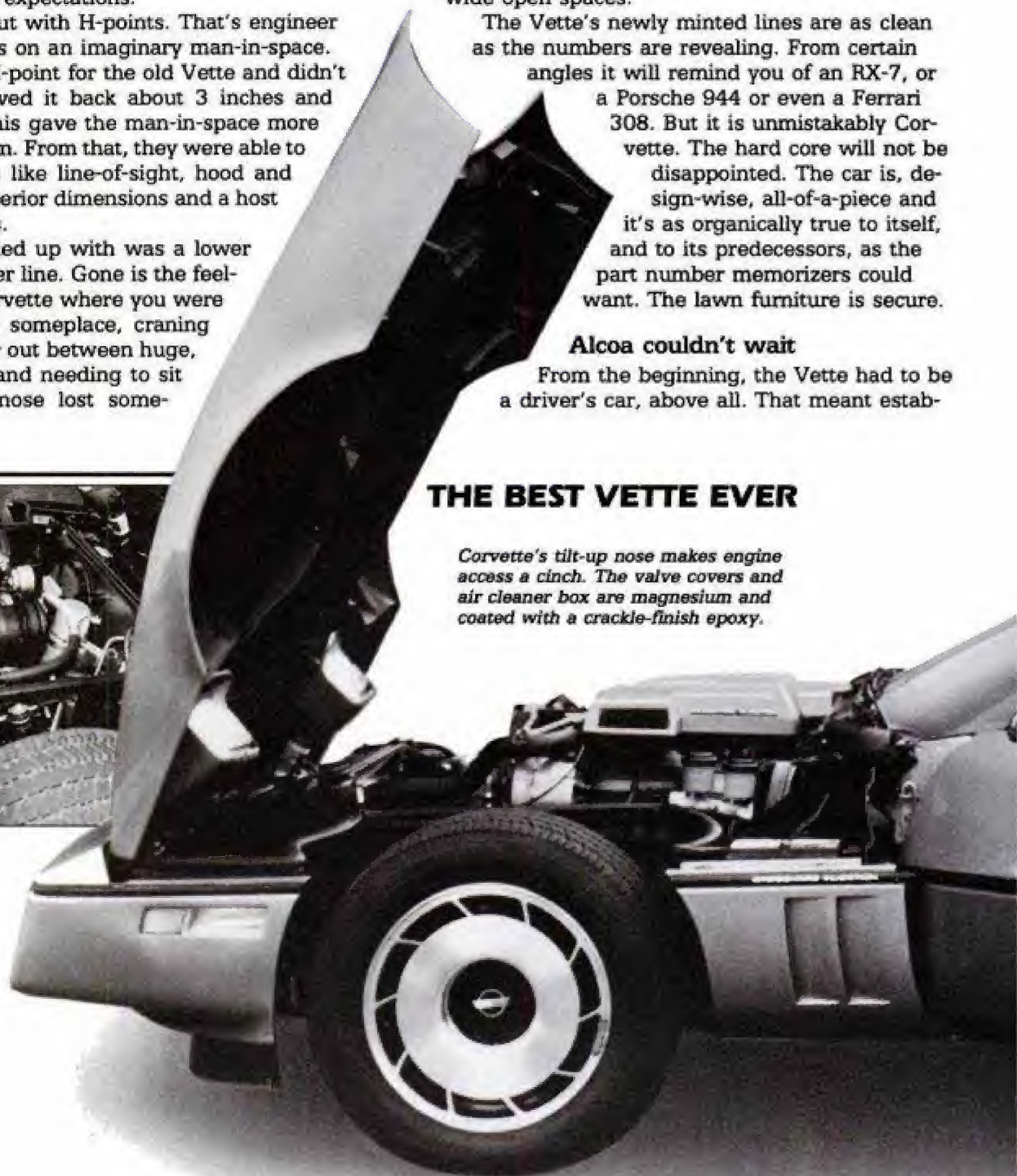
The Vette's newly minted lines are as clean as the numbers are revealing. From certain angles it will remind you of an RX-7, or a Porsche 944 or even a Ferrari 308. But it is unmistakably Corvette. The hard core will not be disappointed. The car is, design-wise, all-of-a-piece and it's as organically true to itself, and to its predecessors, as the part number memorizers could want. The lawn furniture is secure.

### Alcoa couldn't wait

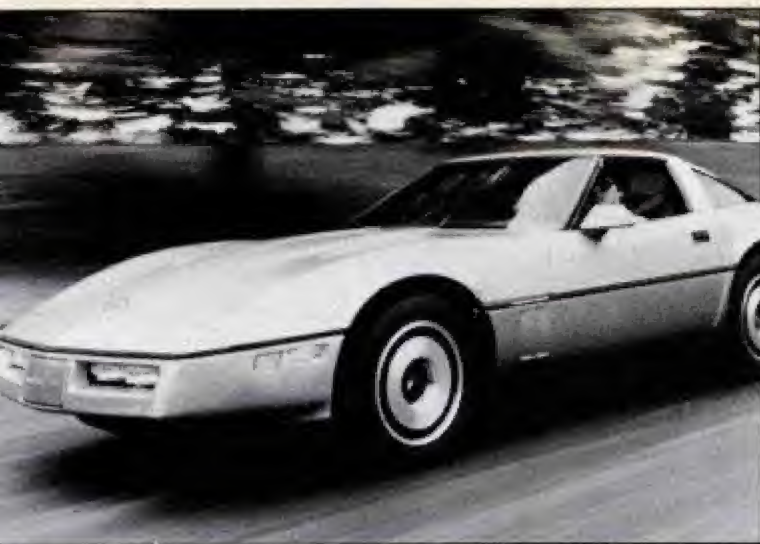
From the beginning, the Vette had to be a driver's car, above all. That meant estab-

## THE BEST VETTE EVER

*Corvette's tilt-up nose makes engine access a cinch. The valve covers and air cleaner box are magnesium and coated with a crackle-finish epoxy.*







lishing some pretty ambitious design goals and accepting no compromises until those goals were met or exceeded. Just for the record, the Vette can generate .95 g lateral acceleration. That's right up there in ear-bleeding territory. For comparison, middle-of-the-pack, production-based road race cars on slicks with full tilt, no-compliance suspensions will generate maybe 1.2. The factors contributing to the Vette's high lateral acceleration number are a combination of tires, unsprung weight, suspension design and a 50/50 weight distribution.

Starting from the ground up, the top-of-the-line tire option is a Goodyear 255/50VR16 blackwall Eagle GT, mounted on 16-inch wheels, 8.5 inches wide in front and 9.5 inches wide in back. The tread design is derived from Goodyear's Formula 1 rain tire and it is oriented. That means it's meant to spin in one direction only. Yet, even if the local garage installs it backward, it will still outcorner just about anything else on the street,

*(Please turn to page 127)*

*Hulking fenders of previous models have been shaved clean (top) and all the lines blended into a smooth shape. Overall, new car is shorter, lower and wider by 2 inches than the 1982 Vette. The interior has been widened (left) and totally redone with digital gauges and excellent seats.*



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ПВ-0205

EWAB

# Strange Bedfellows ON THE High Seas

**T**he *18 Svezd Vlksm* (18th Congress), a large gray ship, its superstructure teared with streaks of rust, wallows gently in the swells among smaller fishing boats. She is not a handsome ship, nor has she the grace of line of the newer stern trawlers. Her only color is the yellow Soviet emblem of hammer and sickle on her stack and a tattered red flag that snaps crisply in the Arctic wind.

A hundred yards astern, bobbing with considerably less grace, is the *Great Pacific*, a small, blue-hulled American fishing boat. The seas, of little concern to the Soviet ship, toss the little American vessel from port to

starboard like a discarded bottle.

The Soviet ship hoists the *Great Pacific's* net, bulging with thousands of pounds of bottom fish, slowly up its stern ramp. Across the water the young crew of the *Great Pacific* lines the gunwales, watching its net disappear slowly up the Soviet vessel's gaping ramp.

"I hope they don't blow it," one of the Americans mutters as the huge bag of fish is lifted above the Soviet ship's wood trawl deck, casting a long shadow over the seas.

If there is tension between these two superpowers, it is difficult to discern. Their thoughts seem concentrat-

ed only on the difficult transfer operation and the success of their catch, part of a long, hard day's work.

Aboard the *18 Svezd Vlksm*, a Russian seaman pulls one net line and then another and tons of small olive pollock and larger whiskered cod spill out, rising thigh-high among the crew.

The *Great Pacific* and the *18 Svezd Vlksm* are fishing side by side here in the Bering Sea off the Alaska coast under the approbative umbrella of the Fisheries Conservation and Management Act of 1976. This so-called 200-mile-limit law was written by the U.S. Congress to encourage the develop-





Soviet technology and American sweat make for a little-known joint venture in offshore fishing.

BY JOHN BURNETT

American fisherman bobs in his much smaller trawling vessel as he waves a greeting to large Soviet factory ship, *18th Congress*. Working U.S. territorial waters off Alaska under a strict quota system supervised by the Coast Guard, Americans and Russians are cooperating to exploit bottom fish.



Below the decks of the Soviet factory ship *18th Congress*, trained crewmen, dressed in surgical garb, examine the fish to remove harmful parasites from them.



Russian crew (left) works on newly delivered catch. After deheading and filleting, the fish will be flash-frozen into blocks (above), then labeled appropriately.



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the fish the  
as teach the  
to go after

subsidized by their governments, methodically swept the ocean bed clean of many species of fish before moving on to other seas. These "vacuum sweeps," as the fishermen call them, forced the law to tightly restrict the activities of these foreign vessels by placing quotas fixed by permit on each nation's fleet fishing within 200 miles of the U.S. coast.

The *18 Svezd Vlksm* and the *Great Pacific* are part of a unique Soviet-American arrangement in which development of the American fishing industry transcends the saber rattling of international tensions. Here, the Sovi-

the oft-neglected bottom fish off Alaska.

The sea-based Soviet processing includes deheading, filleting and flash-freezing the fish into frozen blocks which are then sold on the world market in boxes labeled: PRODUCT OF USSR-USA.

The Soviet-American joint venture is a step toward what the 200-mile law sought to promote. The purpose of the law, as it is written, is "to encourage development by the United States fishing industry of fisheries which are currently underutilized or not utilized by U.S. fishermen, including bottom fish off Alaska."



Crewmen aboard *18th Congress* (above) admire 20 to 30 tons of cod, a prized catch which fetches 9 cents per pound on the market.

At left, the Russian stern trawler *Alaska* pulls 16 tons of American-caught bottom fish up its stern ramp and into ship for processing.

Below, Russian-speaking American Beth Dunning, an observer aboard the *18th Congress*, takes a short breather from her duties. Under contract to the U.S. National Marine Fisheries Service, she and others collect statistical data of each catch's average species, weight, length and sex makeup.





In addition to processing the catch, the Soviets are teaching Americans how to trawl—sweep the bottom with nets—on a grand scale for “underutilized” bottom dwellers such as Pacific cod and walleyed pollock. The Soviets, better equipped and with many more years’ experience, have traditionally sought these bottom fish while the Americans have ignored the species, considering them “trash.”

However, the price per pound has now become attractive to the Americans because of the Soviets’ sea-based processing capability. Americans have never had these capabilities on the fishing grounds and immediate processing is mandatory because hormonal changes and parasites turn pollock to mush only hours after they are scooped off the bottom.

For the Soviets, the financial benefit of this arrangement is just as important; they get a good price for the processed product when they sell it on the world market. (The American fishermen are paid a fixed fee per ton for their catch.) However, the reason the Soviets are only processing and not fishing here is considerably more complicated.

Three years ago, President Carter ordered the hundred or so Soviet fishing boats from the rich Bering Sea in retaliation for the Soviet invasion of Afghanistan. But this joint venture between the Soviet processing vessels and the American fishing boats was protected by the 200-mile law because of its developmental assistance to the American fishing industry.

To the Soviets, this processing venture also provides them an opportunity to show that, despite Western reac-

tion to their military activities in southwest Asia, they are still willing to help the Americans develop their industry. In addition, they also hope that when new permits to fish these abundant grounds are issued, the U.S. will reflect favorably upon their help in developing the underutilized fishery.

The *Great Pacific’s* net, containing thousands of pounds of bottom fish, is being transferred to the Soviet vessel. The American crew, lining the gun-wales, watch their harvest intently as

sign and American fishermen may harvest.

“There, that bunch is ready,” she mutters wearily, struggling to move the heavy baskets off to the side away from the work area.

“Ready to what?”

“Ready to sex,” she laughs. “I estimate the composition of species per catch—get weight and length of each fish, then get their sex.”

“Sex?”

“Yes,” she says. “My office requires that I figure the average num-

## ‘There’s as much luck involved here as in sitting in a bass boat with a bamboo pole in a down-home fishing hole.’

it is hoisted up the Soviet ship’s gaping stern ramp. To these young Americans, their net represents part of a long day’s work.

Aboard the *18 Svezd Viskm*, a young American woman with wisps of auburn hair falling out from under her hard hat, stands in the middle of the pile of squirming fish and tosses a few into a plastic laundry basket. Beth Dunning, a Russian-speaking fish biologist under contract to the U.S. National Marine Fisheries Service, is taking statistical data on the catch. She is one of the many young people assigned to foreign vessels fishing within the 200-mile Fisheries Conservation Zone.

The information gleaned through Beth’s research is one of the tools the Government uses to determine the health of the fisheries resources and the subsequent quantity of fish for-

ber of each sex per catch.”

She places a small halibut along a plastic measuring chart laid out on the deck. Halibut, crab and salmon, universally prized species on any table, are fish prohibited to all foreign ships under the 200-mile law. Possession by foreign ships has resulted in seizure of the vessel.

An older crewman with some apparent authority and sporting a row of solid-gold front teeth approaches from behind and unexpectedly picks up Beth’s halibut.

“*Nyet, nyet!*” she says, quickly jumping to her feet and grabbing the man’s arm.

He rebukes her sharply in Russian, jerking his head toward the open sea. Defiantly, he walks to the edge and throws the halibut over the side. He turns to her, plants his fists into his

(Please turn to page 134)

Beneath the decks of the Soviet factory ship (below left), two busy assembly-line workers inspect and pack the fish into pans to be flash-frozen into blocks. Below right, the American catcher boat *Ocean Harvester* cuts the whitecaps of the Bering Sea.





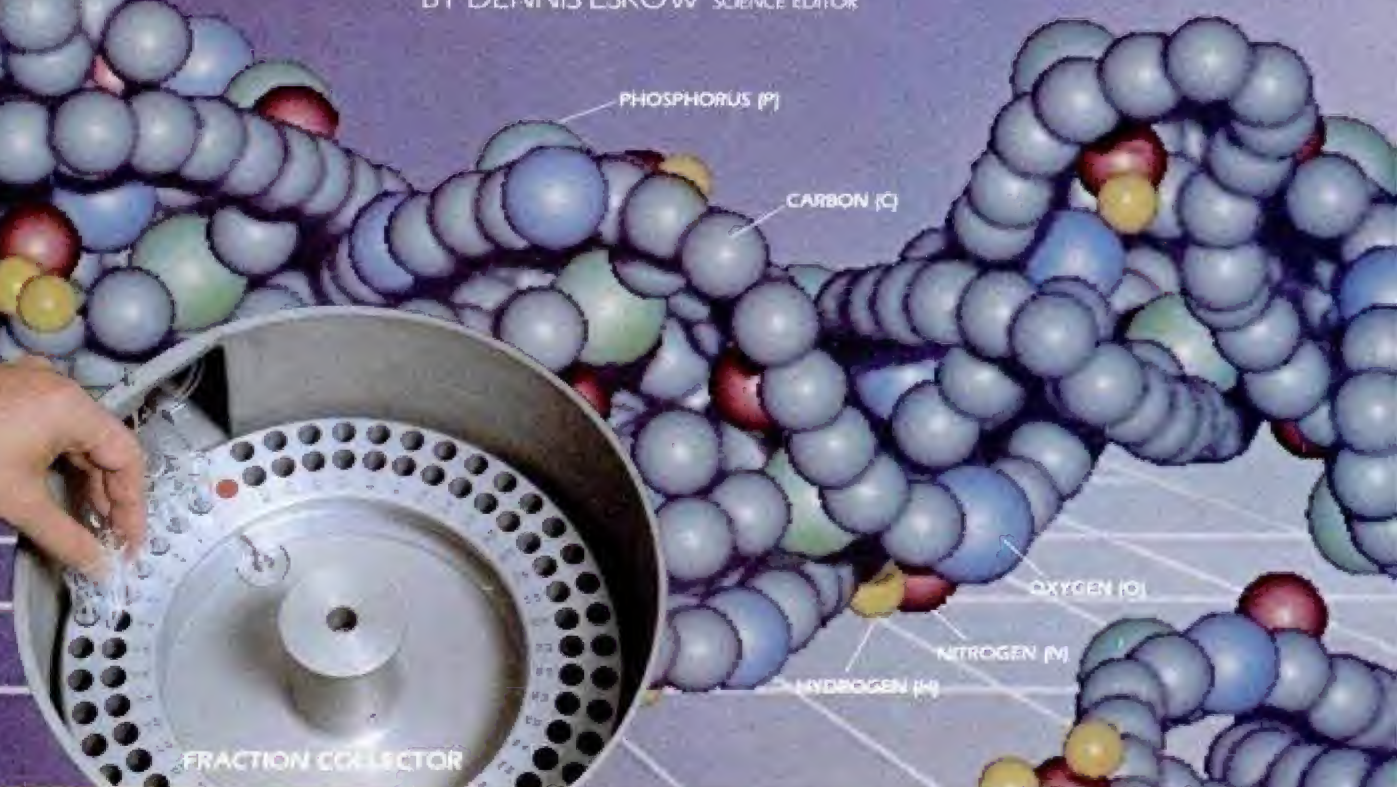
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# HERE COME THE ASSEMBLY-LINE GENES

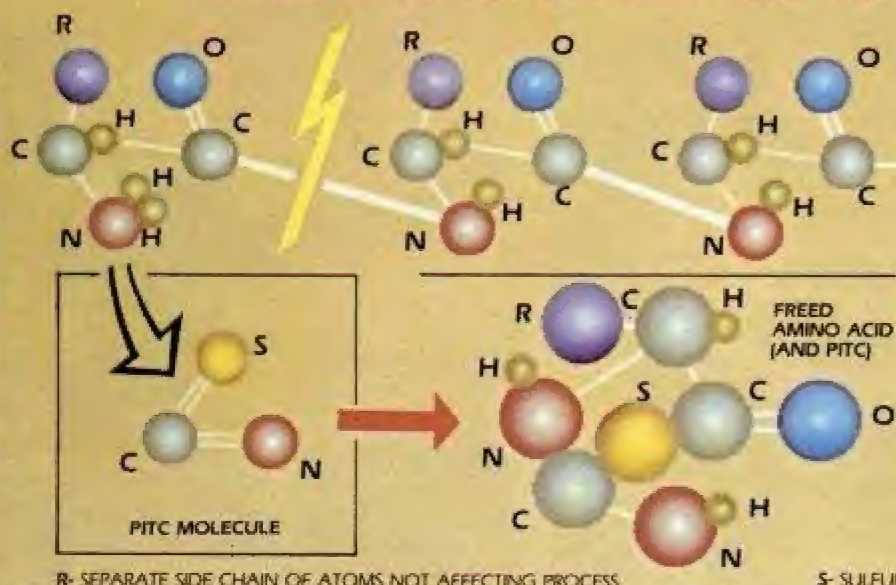
To create life's most important proteins, we're building living cells with unprecedented speed.

BY DENNIS ESKOW SCIENCE EDITOR

PROTEIN CHAIN



## FREEING AN AMINO ACID LINK FROM THE PROTEIN CHAIN



To mass-produce genetically engineered products like artificial insulin, scientists first have to figure out number, order of amino acid links that make up product's protein chain (long spiraling molecule in computer graphics above). One by one, individual amino acid links are pulled away from the protein chain in the reaction chamber of a protein/peptide sequencer (facing page). A link is freed (left) when a chemical called PITC acts on it. This is done until all amino acid links are separated, counted and tagged in the machine's fraction collector (photograph above).

R- SEPARATE SIDE CHAIN OF ATOMS NOT AFFECTING PROCESS

S- SULFUR





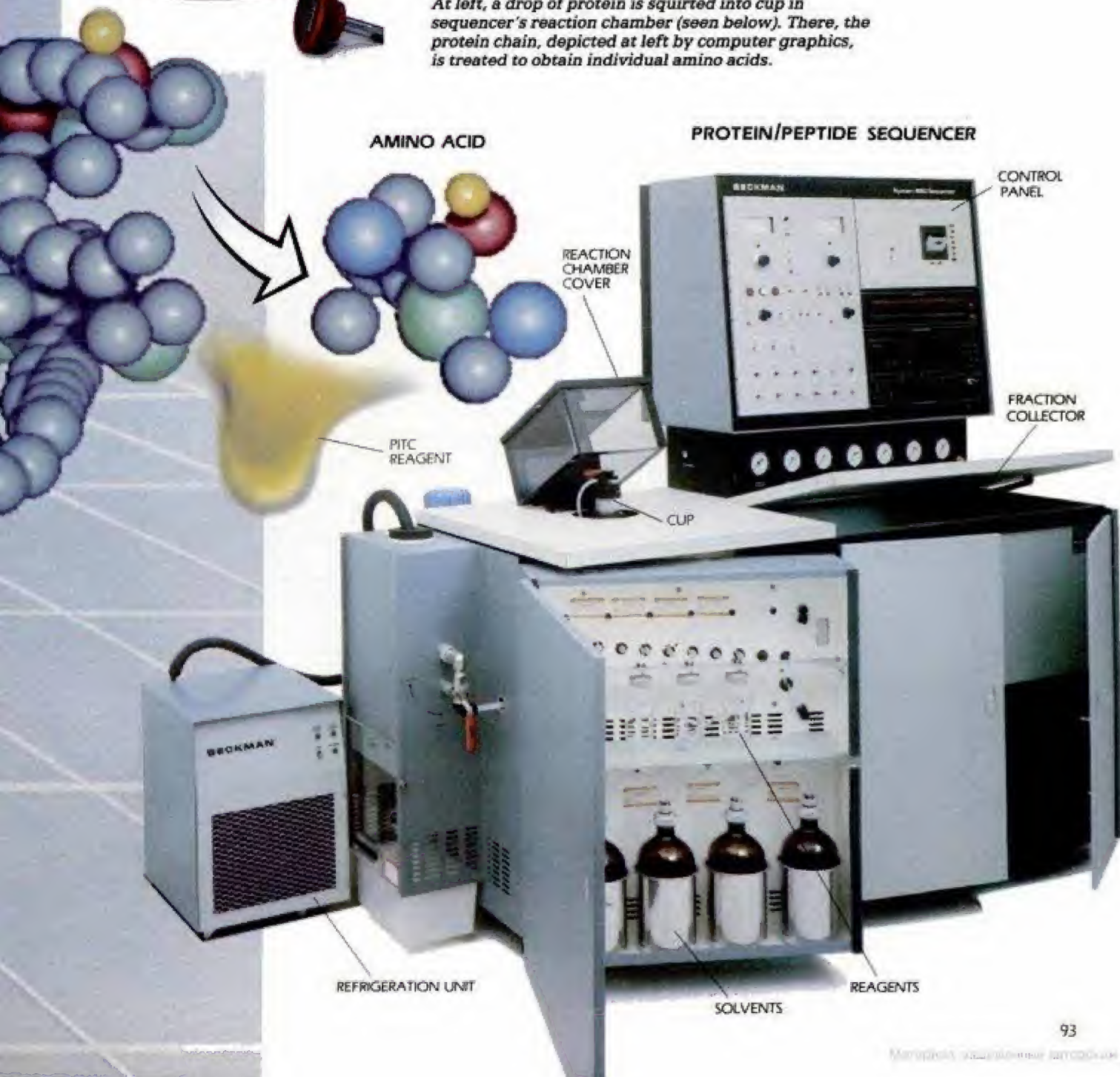
In half the time it takes you to blink your eyes, nature links together thousands of chemical groups to form the tiny molecules that determine your size, shape, hair color, blood type—all the parts and specifications of a human being. And, while man isn't nearly as fast as nature, a revolution in genetic engineering machines is giving her a run for her money.

Already we're cloning human insulin; hormones to make cows double their milk production, and interferon—a protein that may become the most powerful weapon in the war against cancer. Using high-speed, computerized machines, scientists who are part biologist and part engineer have begun mass-producing bacteria that eat raw sewage and lick up oil spills.

"Before automation, one step could take one week; now it can be done in an hour," says Mahmet Pamukcu, a product manager for Beckman, the giant of the gene machine industry. "You can actually map out an entire protein in a week."

Insulin is a protein. So is interferon. In fact, the science now known as genetic engineering was originally a branch of biochemistry called

*At left, a drop of protein is squirted into cup in sequencer's reaction chamber (seen below). There, the protein chain, depicted at left by computer graphics, is treated to obtain individual amino acids.*





protein synthesis. To create a protein, the body hooks together just 20 amino acids in hundreds, even thousands, of varying orders. A single protein molecule might be made up of thousands of amino acids. But it's not enough to know which acids make up the protein or how much of each acid is inside. Two different proteins can contain the same amount of the same acids and be as different as night and day. To know exactly what makes up a protein—which is necessary to clone it—you have to know the exact order in which the acid links made up the protein chain.

Enter machines like the Beckman 890D Protein/Peptide Sequencer. At first glance, it looks like a Xerox copier, but it helps scientists copy much more than office memos.

In the reaction chamber, a drop of protein in a shot-glass cup is spun gently. This keeps the protein from denaturing—undergoing an irreversible change in its chemical makeup. This begins a process that will break the chain into tens of thousands of amino acid links in exactly the order in which they are strung together.

On the first cycle of operation, the

# If you could unwind just a single DNA spiral—one molecule—it would stretch out for three feet.

Beckman machine automatically sprays a special chemical reagent into the cup. The most commonly used reagent is called PITC. It pulls on one end of the first amino acid molecule, while pushing the other end away with forces similar to magnetism.

In the next step, the machine adds buffer, washing away any excess PITC in the cup. Too much PITC would destroy the protein chain. (Of course, if too little were added, the amino acid would be left dangling from the end of the chain. It would be snapped, however, on a second or third pass.)

The PITC leaves the shot glass through a gravity tube. But the amino acid, after it has been cleaved, gets sucked into a vacuum tube and shunted to a revolving tray called the fraction collector, a Lazy Susan with circular rows of test tubes. When the first acid lands inside the first tube, the tray

rotates. The process continues until all the acids are counted out, one by one. Of course, no tray would be large enough to sequence all the acids of a typical protein, so the system has to be serviced by human hands every few hours.

Just as the proteins are chains of amino acids, the most basic molecules of life—the genes—are part of a long-chained molecule known as *deoxyribonucleic acid*, or DNA. A DNA molecule is shaped like a spiral staircase made of long strands of protein. The chemicals that link the sections of a DNA molecule are called nucleotides. And, in nature, these are split apart in a process similar to that used in the protein sequencer. The DNA molecule is among the largest in biology. If you could unwind a single DNA spiral, an American Chemical Society paper says, it would stretch out for three feet.

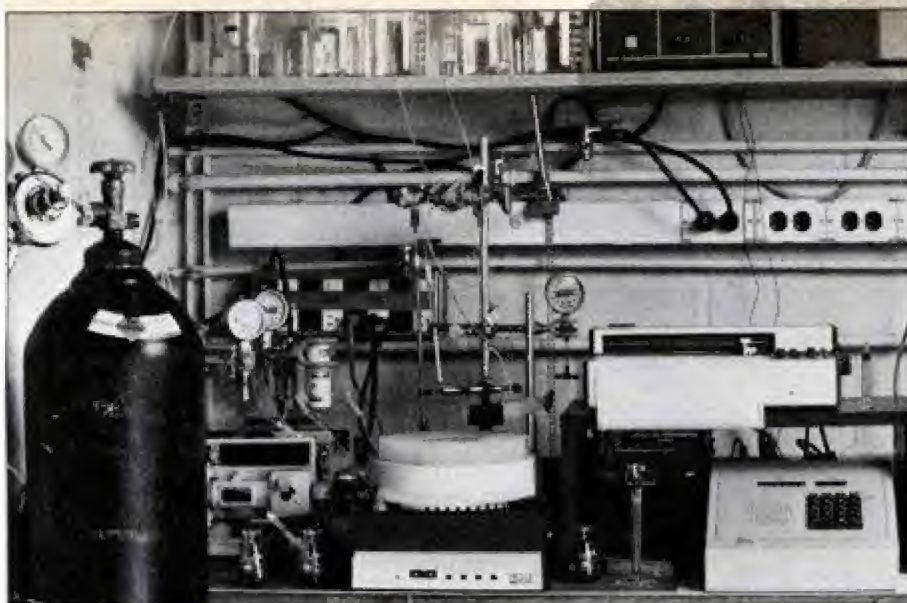
*Main culture unit at New Brunswick Scientific holds bacteria in a 125-gallon vessel filled with chemicals that keep desirable cells alive. These cells produce interferon and other chemicals. Cells are transferred in 50-gallon increments to suspension vessel, where bacteria are separated from nutritive chemicals. Small tanks maintain chemical environment for specific bacteria to reproduce.*

SUSPENSION  
VESSEL

BACTERIA  
VESSEL

CHEMICAL  
TANKS





*Genetic engineering has a do-it-yourself side; High Performance Liquid Chromatography system (above) is put together from components. The HPLC separates amino acids for analysis. Cal Tech's sequencer (left) will be out this year.*

Until recently, the only way to analyze DNA molecules was to break them down into their protein parts. But even that hurdle has been overcome with the advent of high-speed "nucleotide sequencers" that can analyze DNA as fast as the Beckman machine maps out a protein.

On the market already are nucleotide sequencers made by Vega, whose equipment is instrumental in mass-producing cloned insulin. And California Institute of Technology researcher Leroy Hood is expected to introduce in the next year a new DNA sequencer that, working with other equipment, will be hundreds of times more sensitive than anything on the market.

Once scientists have the blueprint for a protein or DNA chain, they can copy it easily. With machines that reverse the sequencing process, they can mix the oxygen, carbon, nitrogen, phosphorous and hydrogen that comprise a protein chain. But most genetic engineers prefer to build a protein-sequencing system into living bacteria.

"Bacteria work faster, and perhaps more accurately, than any machine man can build," says MIT's Philip Sharp.

Creating a bacterial factory starts with knowing the protein sequence. Then, you have to find a bacterium—a one-celled microscopic creature—that will reproduce your chemical exactly. By getting one sequence wrong, a

researcher could turn a medicine into a poison. To get to the correct bacterium for reproducing your protein, you have to raise millions of bacteria in an incubation system. In a chemical broth, a group of bacteria—most often *E. coli* from the human intestines—is permitted to grow wildly. The researcher wants only one kind of *E. coli* bacterium, but he has to grow millions to raise one with the specific traits he needs.

During the weeks and months spent

searching for a prospective one-celled bacterium, the scientist notes conditions under which that particular specimen will survive—high temperature, the absence of a specific chemical or other factors. When the desired bacterium is born, conditions are changed in the incubator that allow only that type to survive. The undesirable creatures are then killed off.

With this technique, genetic engineers need only maintain tight controls on the vats that contain the bacteria and they can have a continuous supply of a protein, interferon, for example. The bacteria, as small as they are, only produce tiny amounts of interferon each, so quite a large batch—hundreds of gallons—must be raised to get a useful supply.

Once the bacteria are reproducing and making interferon, processors can separate the drug from the cell with chemical treatments. While the first ounce of cloned interferon reportedly cost tens of thousands of dollars, subsequent ounces have been far less expensive, permitting researchers in the United States and Europe to try it out on cancer patients. In a small number of tests here, it has shown an ability to slow the growth of tumors. But some French patients died earlier than expected under the treatment.

Genetic engineering has given rise to a whole new do-it-yourself market, especially among the 150 or so labs devoted strictly to protein chemistry.

"This is a young industry, and many of the smaller labs are trying out different equipment configurations for their

*(Please turn to page 124)*



*Vega's Leon Barstow makes adjustments to the chemical mixture inside the polynucleotide synthesizer. Vega also manufactures a peptide synthesizer. Both of these machines function somewhat like the Beckman sequencer, but in reverse, assembling DNA strands or protein.*



\$2,918.00 Spread

# MAKE YOUR OWN Weather Forecasts

Use PM's chart to predict tomorrow's weather, or create a home weather station that's the rival of professional forecasting setups!

BY DENNIS ESKOW SCIENCE EDITOR

If you get all your weather forecasts from a radio or TV meteorologist, your life is about to undergo a radical change. By the time you finish reading this article, you'll be able to predict tomorrow's weather, and perhaps the next day's, with better accuracy than the eternally smiling TV weatherman. And, of course, you'll be more accurate than those ancient magicians who forecast the next day's weather by the number of halos around the moon. (Halo watching is often effective. It's explained later.)

Man has been forecasting weather since before the invention of the wheel. And with the advent of computers, satellite photos and advanced mathematics, we've gotten even better at looking ahead. But you can still improve on the predictions of the professional meteorologist. By combining his barometric reading with the local wind conditions in your area, you can use PM's weather chart to get a more accurate forecast of the weather in your own neighborhood for 24 hours. Add a \$10 analog forecaster and you can extend your prediction up to 36 hours or



Capricorn II Digital  
Weather Console



more. With PM's chart and a \$50 barometer, you can predict tomorrow's weather with uncanny accuracy, certainly better than the forecast your weatherman prepares from a distance away. Finally, by adding the information-storing and precision-sensing capabilities of a computerized weather station (\$399 to \$990), you'll be able to make three-day forecasts that are as good as, or better than, the weatherman's.

It isn't that television forecasters are brainless. Professional meteorologists generally are trained in the sciences and have at least a nodding acquaintance with the computer technologies on which they depend. Their problem is one of scope: They must forecast weather for an area roughly 50 to 80 miles in diameter, or thousands of square miles. Some of the territory is at high elevation, some is near water and some is surrounded by forests and hills. No one can make a 100-percent-accurate forecast under those circumstances.

But, armed with a \$795 Capricorn II Weather Station (from Edmund Sci-

[\(Please turn to page 148\)](#)

*With PM's weather chart (right) you can predict the next day's weather.*

*Practice using it with barometric-pressure and wind-direction readings you hear over the radio.*

*In order to become a do-it-yourself weatherman, you'll need instruments and aids, some of which are shown below: Sager guide tells you how to read other indicators, like clouds. Mechanical instruments in the Downeaster station can be purchased separately. Rainwise unit provides digital readings. Add a rain gauge, a wind-chill meter and a tide clock and you have everything that a professional has, except a satellite- or computer-generated map.*

## HERE'S HOW TO FORECAST TOMORROW'S WEATHER

IF WIND SHIFTS...	AND BAROMETER READS...	THE WEATHER WILL BE...
SW to NW	30.1-30.2 Steady	Fair
SW to NW	30.1-30.2 RR	Fair; rain in 2 days
SW to NW	30.2 + Steady	Continued fair
Westward	29.8 - RR	Clearing, colder
S to SW	30.00 - RS	Clearing today
S to SE	30.1-30.2 FS	Rain
S to SE	30.2 FR	Increasing wind; rain tomorrow
SE to NE	30.2 FS	Rain in 12 hours
SE to NE	30.2 FR	Increasing wind; rain tomorrow
E to NE	30.1 + FS	Rain in 24 hours in winter; if wind's light, no rain in summer
SE to NE	30.00 - FS	Rain continues
SE to NE	30.00 - FR	Severe storm
E to NE	29.8 - FR	Heavy snow in winter; severe northeast gale in summer

RR: Rising rapidly  
FR: Falling rapidly

RS: Rising slowly  
FS: Falling slowly

+ : And higher  
- : And lower

PM photos: Peter Tenzer

Capricorn II weather station (left), placed indoors, connects to outdoor sensors, like the anemometer shown. Digital readouts give temperature, barometric pressure, wind speed and direction; features like alarm and memory alert you to sudden changes in weather.

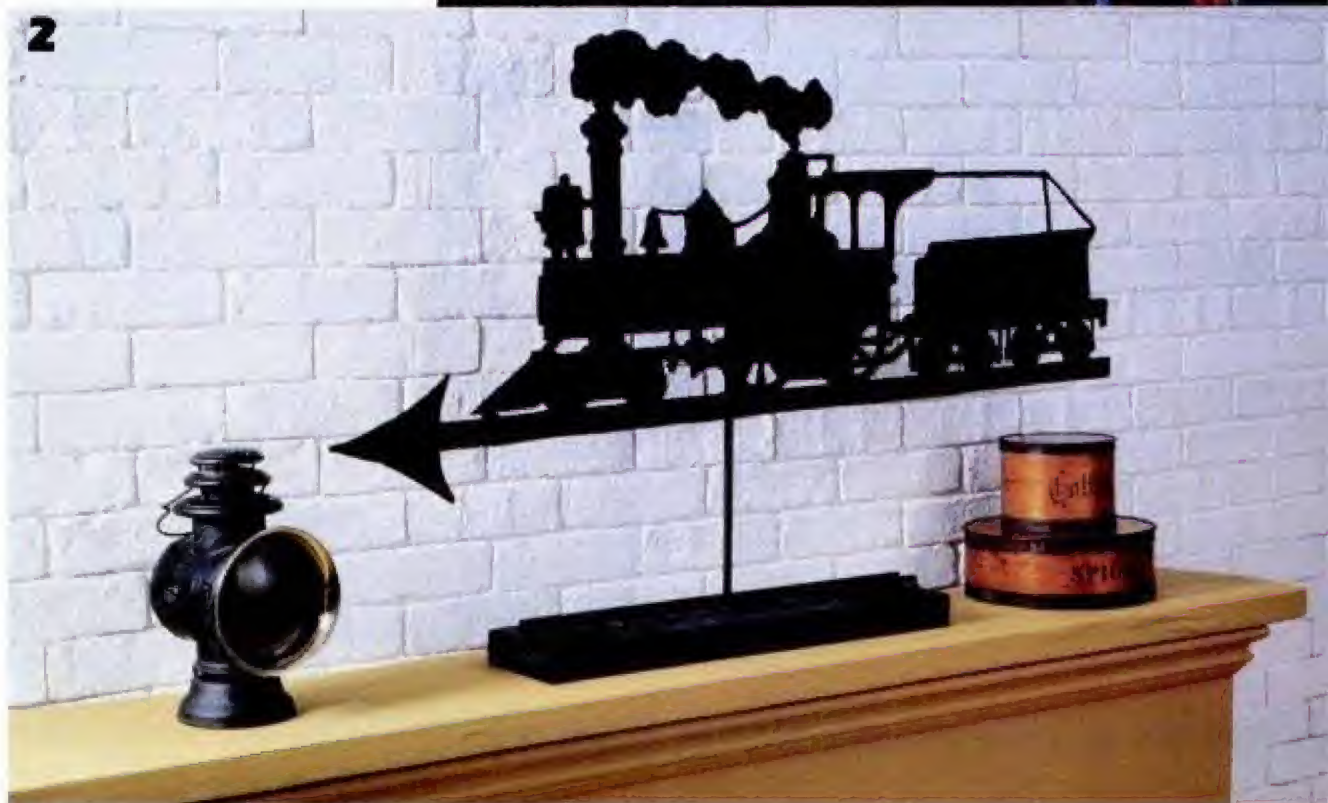
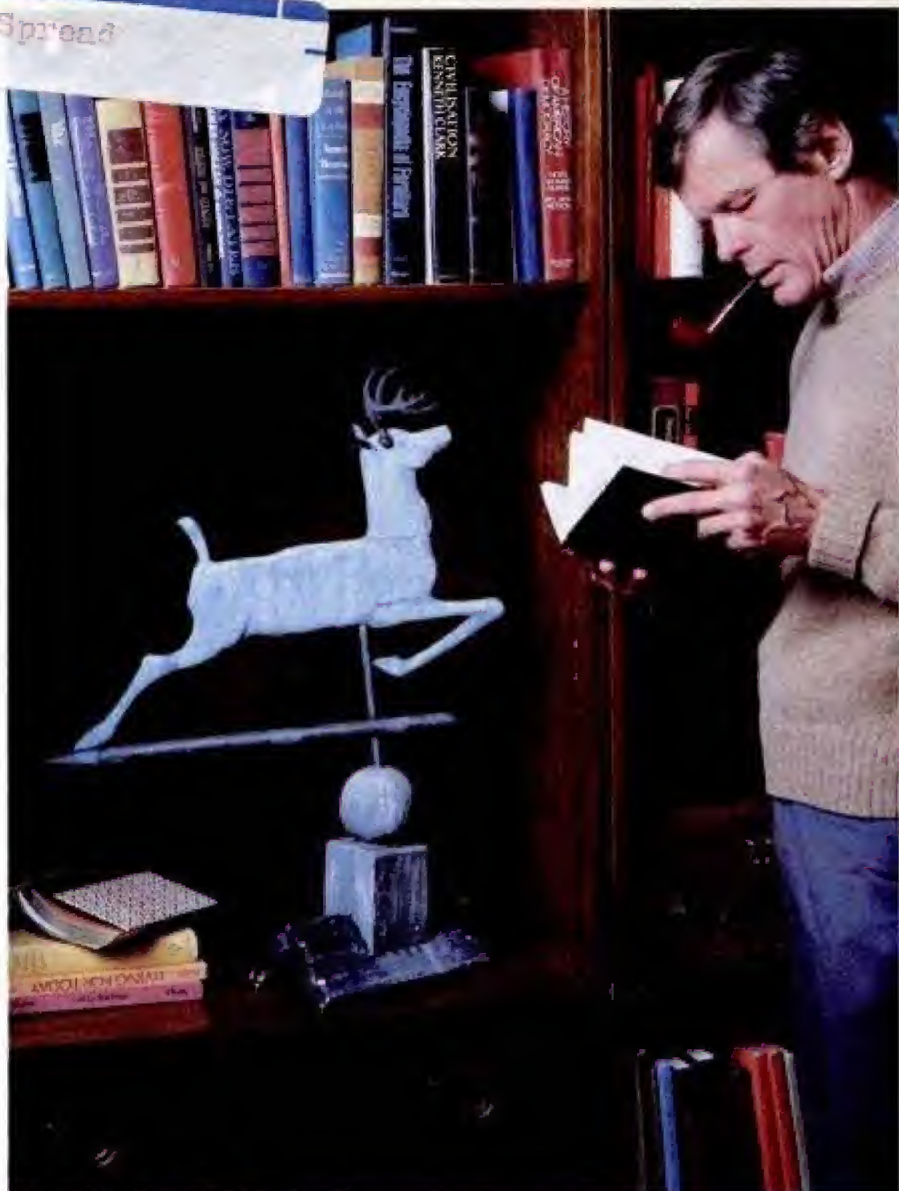




# Country Weather Vanes You Can Make In Your Shop

A premier designer of country-style furniture creates four weather vane replicas that you can build for display.

Designer: Adam Peck,  
American Design Inc.  
PM photos: Harry Hartman





**W**eather vanes were a common sight on the landscape of early America. Not only did they prepare our agrarian ancestors for changes in atmospheric conditions, but weather vane construction served as a creative occupation during long winter evenings.

PM asked designer Adam Peck to create several display replicas. All vanes shown are created of either wood, metal or both. The authentic-looking finishes are achieved using Rust-Oleum paints. Complete instructions for building and painting follow.

## 1 Running stag

Although the running stag is made of wood, it is skillfully painted to look as if it's covered with verdigris, the greenish-blue substance that forms on copper, brass and bronze. Since all authen-

3



4



**1** Leaping stag is typical of country weather vanes fashioned by early craftsmen. Adam Peck created this one in wood and applied a finish to simulate look of old copper.

**2** Puffing steam locomotive recalls an earlier era. Constructed of sheet metal painted black, it is mounted on a hardwood base shaped like railroad tracks.

**3** Modeled after a gaff-rigged colonial sloop, PM's America is of wood with metal sails. The original boats of this type were used for pilot and fishing boats.

**4** The Indian stalking a bear can be hung on the wall. The figures are of wood inserted into a metal U-channel and underscored by an arrow carved of wood.



tic weat digris, creating the greenish cast on the running stag assures its authentic appearance.

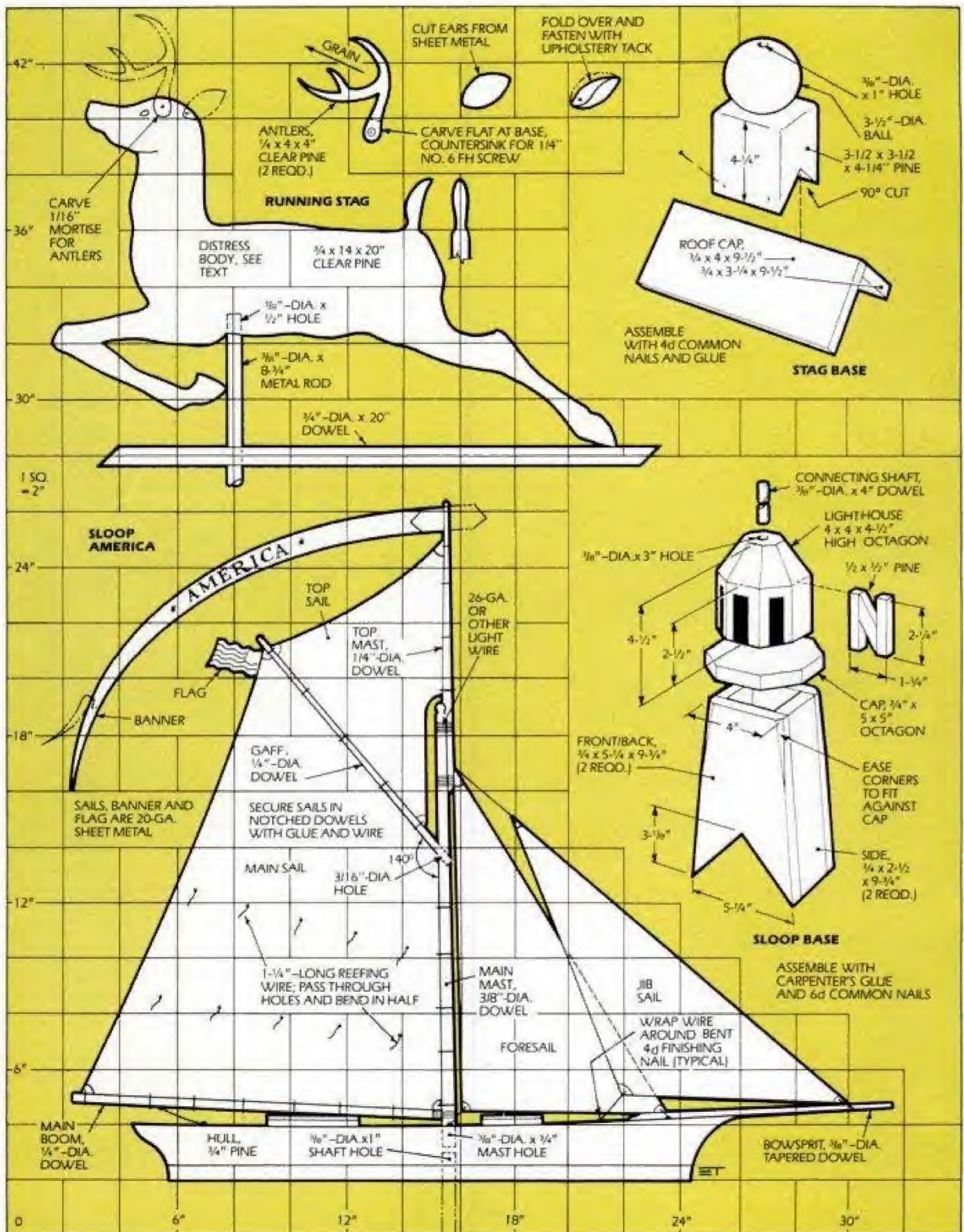
Before you begin work, read the instructions through and round up all

To draw the stag, lay out a full-size grid on  $\frac{3}{4}$ -in. clear pine; draw each square  $2 \times 2$  in. Sketch in the stag pattern, following the drawing directly

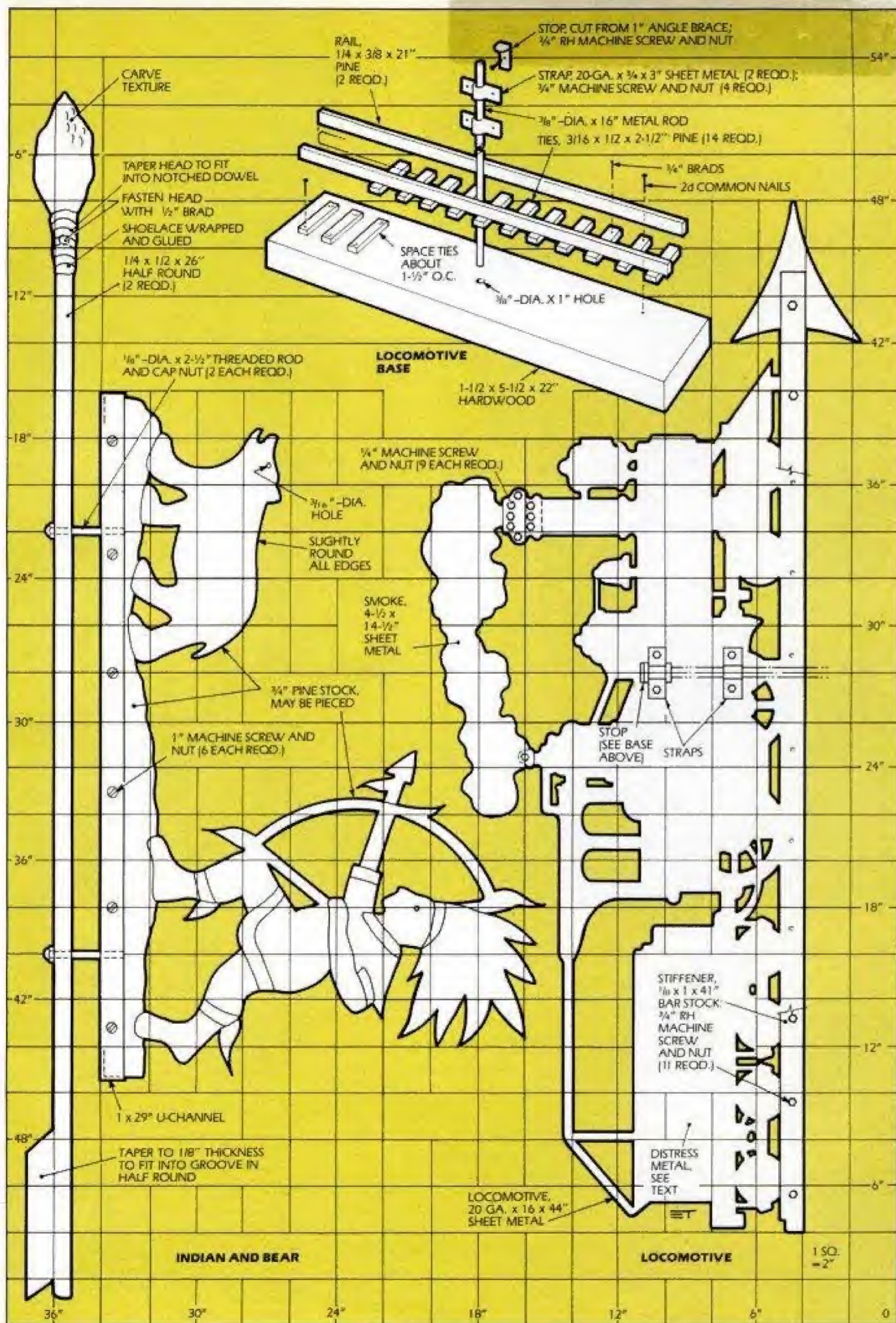
need. Use

below. Draw a grid and transfer the antler pattern onto  $\frac{1}{4}$ -in. stock.

Carefully cut out the stag body with a scroll or band saw. Or rough-cut it with a sabre saw and finish-shape with a  
(Please turn to page 143)











# A Barn For Your Back Yard

Our well-designed yard building provides handsome storage for yard tools, power equipment and gardening supplies. Build it from plans that you buy.

If you visit your local lumber yard or home center you're certain to find several factory-made back-yard buildings on display. Some of them will be relatively low in cost, while others will be more expensive. Many versions will fulfill the storage needs you have—but none will match the "down-home" good looks of the PM building.

Our build-it-yourself beauty was de-

signed and built by William I. Winans.

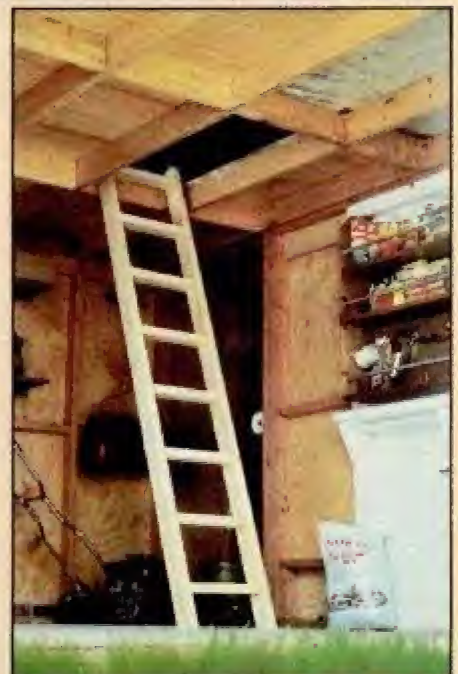
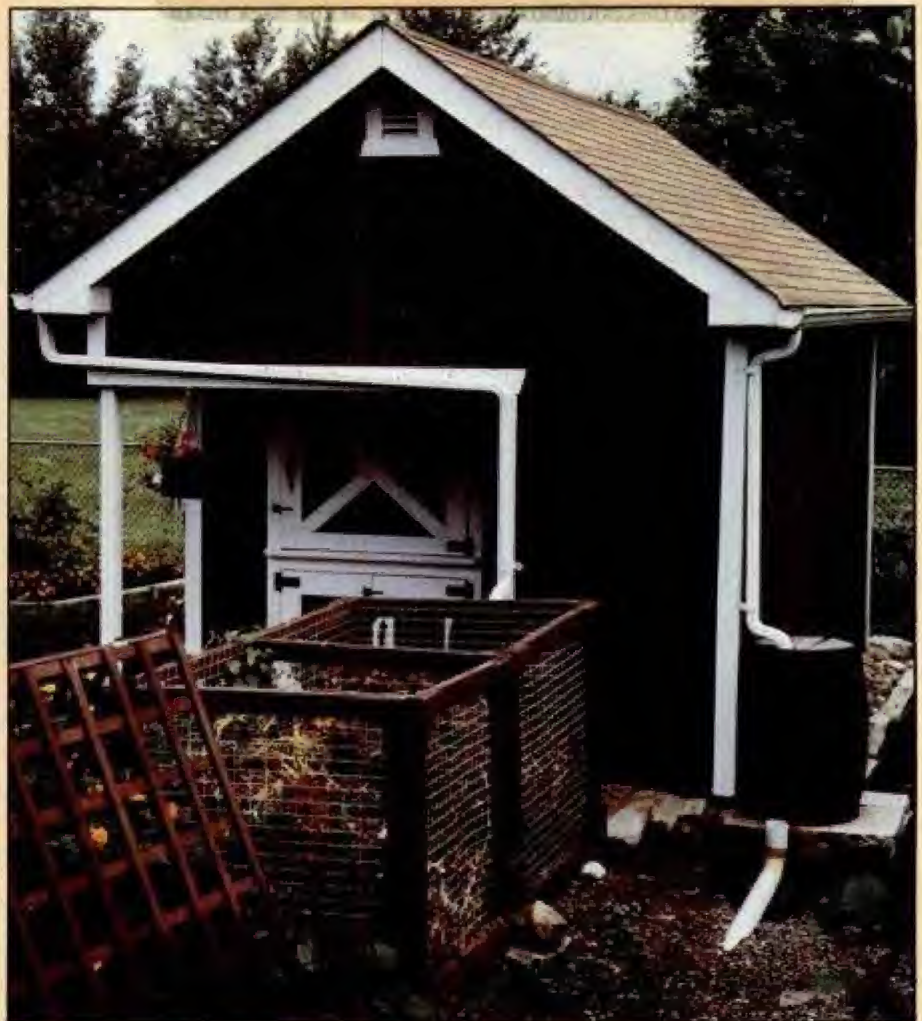
It provides such sorely needed amenities as storage space for large yard equipment and hand tools, and a gardener's center for the family "green thumb"—with attention to design de-

PM photos: Bill Barker  
John Deere garden tractor courtesy Falls Mower & Garden Center, Chagrin Falls, Ohio

## HOW TO ORDER PLANS

The plans for the PM Back-Yard Barn consist of four 17 × 22-inch drawing sheets, a detailed instruction manual and a materials list. A single set of plans is \$10.50. If you need a second set to file for a building permit, two sets can be obtained for \$17.50. Send check or money order to Storage Barn, Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101. Please allow four weeks for delivery.





Overall view (facing page) shows wide barn doors at left end and porch with potting bench at right end. Loft can be reached from outside through overhead doors (center) or from inside by ladder (above). Potting bench (far left) has door with shelves on inside that put gardening supplies at your fingertips when opened. Access doors below bench (near left) let you reach additional supplies from outside barn.



tail that's a unique hit of your neighborhood. There's a bonus, too: Ours has an upstairs loft for additional storage (perfect for storing project lumber).

The carpentry details are easy to understand; designer Winans came up with construction methods that can be tackled by the average do-it-yourselfer, as you can see in the drawing below.

The building's basic dimensions are 12 x 16 ft. This permits economical use of building materials. The unusual upper-level kneewall in front and a joist

design.

To provide extra headroom in the loft—without using additional lumber—designer Winans "dropped" the loft floor, suspending it from joist hangers at the front and resting it on a ledger strip at the rear.

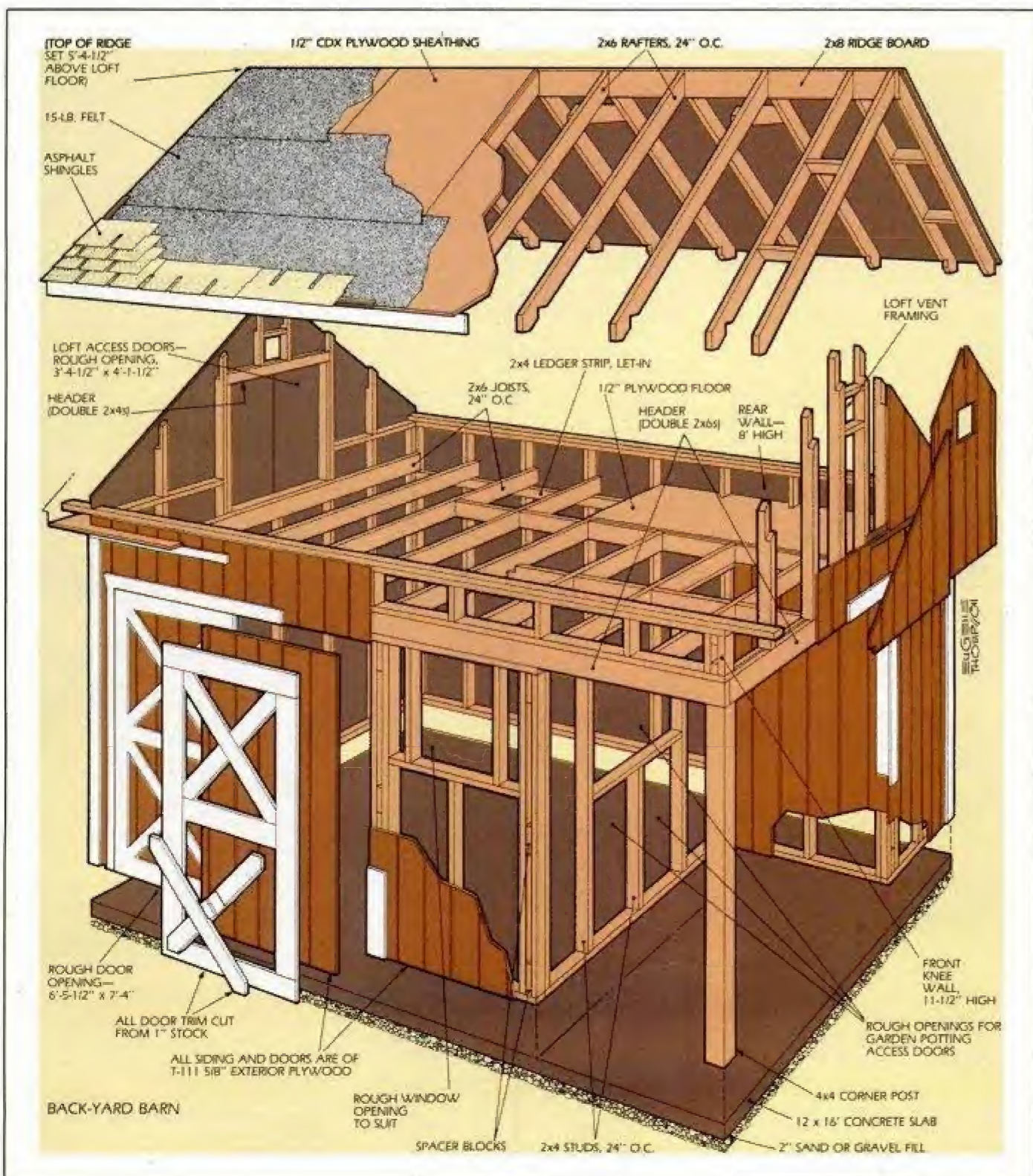
### A useful old trick

Here, an old carpenter's stunt makes it easy to align the hangers with the studs in the rear wall. Hold a straight-edge—a spare 2x4—along the back

wall and mark the stud locations on it. You can then transfer these marks to the front wall to establish the hanger locations.

Your community may or may not require you to have a building permit. To be safe, check with your building department before beginning construction. If a permit is required, you will need an extra set of plans for the building department.

The shed shown is built on a concrete slab which was poured over a well-compacted subgrade. **PM**





# 3 Gardening Aids you Can Build

The potting bench, lettuce shader and caterpillar cloche can turn an "all-thumbs" gardener into a green thumb.

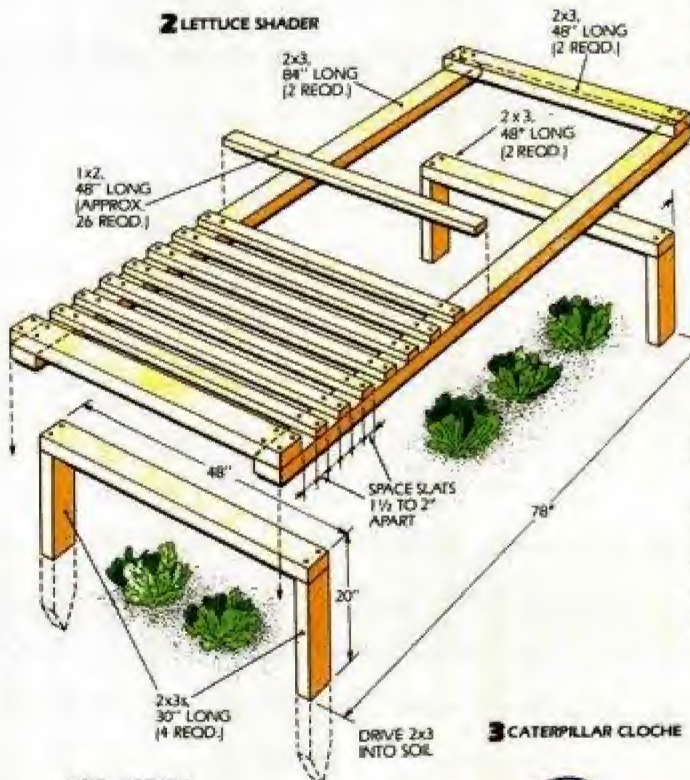
- 1 The potting bench is a scaled-down version of one used in the professional nursery and garden center of Bob Thomson, host of the Victory Garden television program. All details that you need to duplicate it are shown.
- 2 Use a lettuce shader to protect loose leaf, bibb and other lettuce from the sun on sweltering summer days. You can plant a crop in early spring and use the shader to continue growing lettuce through the autumn months.
- 3 An easy-to-construct caterpillar cloche lets you plant outdoor crops earlier and harvest later in cold weather. Gardens For All showed us its cloche, which is based on plans from the National Center for Appropriate Technology.

(For building instructions, please turn to page 125)



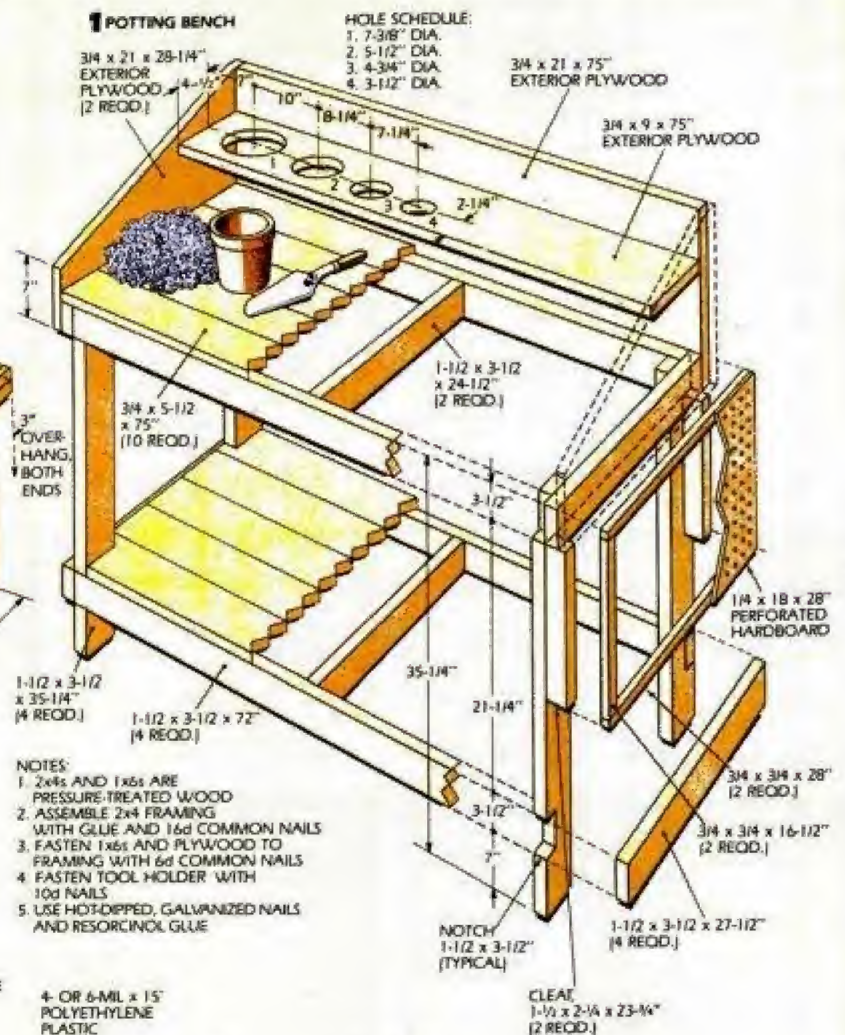
Thomson in Victory Garden greenhouse.

## 2 LETTUCE SHADER

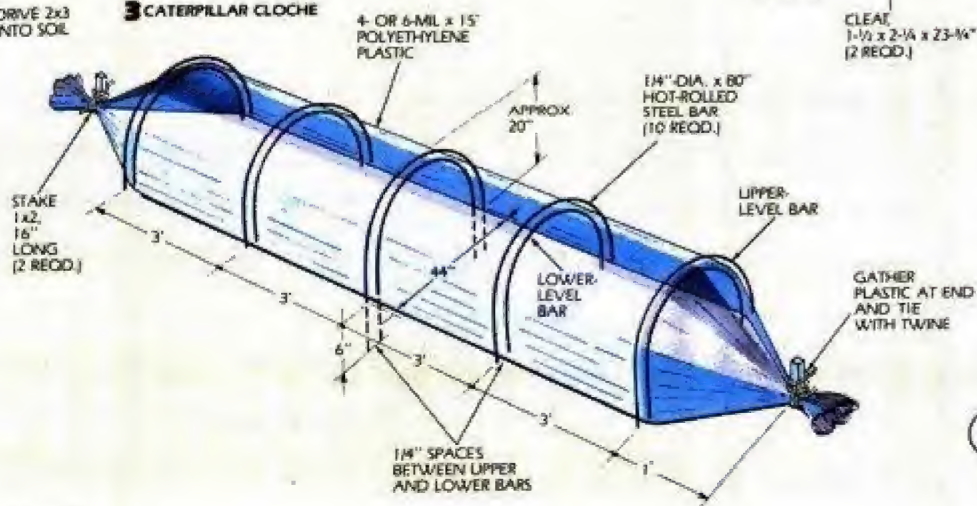


NOTE: ASSEMBLE WITH 6d HOT-DIPPED, GALVANIZED COMMON NAILS

## 1 POTTING BENCH



## 3 CATERPILLAR CLOCHE





# Secrets From A Master Woodcrafter

## 1 CLAMP STUNT

If the swivel pads on your C-clamps become loose and fall off, try this method for replacing them.

First, open the clamp wide and place it in a vise, as shown. Now, strike the end of the screw shaft with a ball-peen hammer to peen the shaft over. Be sure to strike the shaft accurately, for an errant blow could fracture the casting of the clamp.

Once the screw shaft is sufficiently peened, remove the clamp from the vise and position it on a hard surface. Hold the swivel pad in place and tighten the clamp by driving the peened shaft into the swivel pad collar.



Strike the screw shaft to peen the end over (left). Hold the swivel pad in place and tighten the clamp to drive the peened shaft into the collar of the pad (right).

## 2 EXTENDED PIPE CLAMPS



When you find that your pipe clamps are too short for use on a particular project, don't invest in an additional set of longer clamps. Simply extend your existing clamps with lengths of black pipe.

Keep your workshop well supplied with various pipe lengths—threaded on both ends—plus several standard pipe couplings, and you'll be able to clamp almost any project. You're limited only by the length of pipe you have on hand; this procedure works with

either 1/2- or 3/4-in.-dia. pipe clamps. Moreover, you'll obtain more professional results by creating the correct clamp for each job.

To lengthen a clamp, disengage the clamp's tail-stop assembly and slide it off the pipe. Choose the desired length of extension pipe and join it to the "short" clamp with a coupling. Do not use a wrench when adding an extension to a clamp. Hand-tightening is sufficient. Replace the tail-stop assembly and you've got a "new" clamp.

Lengthen your pipe clamps to suit any job. Add the desired length extension to clamp with a standard pipe coupling.

## 3 SCREW-EYE DRIVER

These homemade tools are great for driving screw eyes and hooks of all sizes. Each driver is a 4 1/4-in.-long hardwood birch dowel, and I recommend making four different-size drivers; 3/8-, 1/2-, 5/8- and 3/4-in. dia.

Start by cutting a 1/2-in.-deep saw kerf centered in one end of each driver. Cut the kerf narrow enough to provide a snug fit around the screw eye. Now, measure 1 1/2-in. down from the other end of each driver and center-bore a 1/4-in.-dia. hole to accept a 1/4-in.-dia. x 2 1/2-in.-long dowel handle. The handle adds leverage when you turn in a screw eye or hook. When driving a screw eye



To drive screw eyes, cup hooks and screw hooks of all sizes, use these hardwood birch dowel drivers.

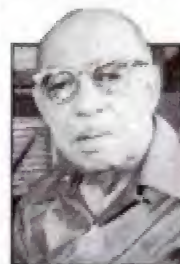
into very hard material, you may need to establish a starting point with an awl, or by first boring a pilot hole with a drill.

### About the author

This is the seventh in a series of articles by master woodcrafters who have devoted many hours toward perfecting their craft.

This installment's craftsman is C. E. "Doc" Banister, who has shared his expertise with PM readers many times in the past. Doc has tested new equipment and reported the results for PM. He has also written many articles revealing shop secrets for obtaining professional woodworking results.

A resident of Oroville, Calif., Doc designs and builds custom furniture of all types, including wall units and music centers. Doc is also a master of special lathe-turning techniques and of designing workshop accessories.

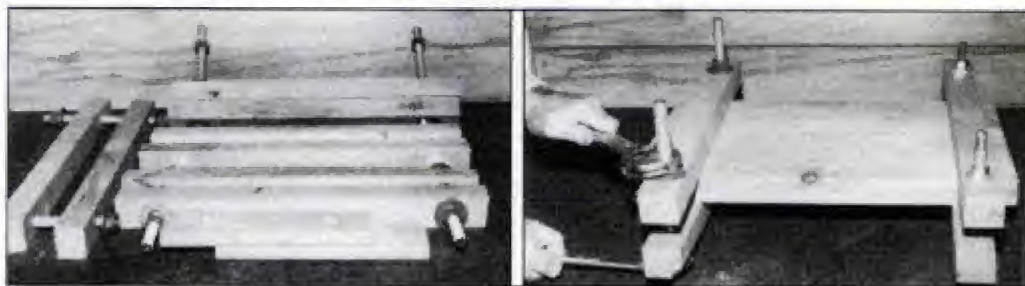




## 4 WOODEN CLAMPS

No home workshop should be without a set of these hardwood oak clamps. Construction consists of a pair of wooden jaws joined by  $\frac{3}{4}$ -in.-dia. threaded rods. Draw the jaws together by tightening nuts placed on the rods.

I made two sizes of wooden clamps to satisfy most of my shop needs. In the larger pair each jaw measures  $1\frac{1}{2} \times 2 \times 22$ -in.; jaws in the smaller pair measure  $1 \times 2\frac{3}{4} \times 10\frac{1}{2}$ -in. The threaded rods pass through  $\frac{3}{4}$ -in.-dia. holes center-



Wooden clamps (left) are limited by jaw length. Tighten nuts to add clamping pressure (right).

bored 2 in. in from each end of the jaw. The upper jaw of each clamp tapers  $\frac{1}{16}$  in. from the center out to each end. This

applies clamping pressure equally to center of the workpiece. Bottom jaws remain flat to keep workpiece true.

## 5 GLUE BRUSH STUNT



Make glue spreaders from nylon brushes (left). Cut bristles down to 1 in. long (right).



I have found an easy and effective way to apply glue to woodworking projects. Take several inexpensive nylon paintbrushes—from  $\frac{1}{2}$  to  $2\frac{1}{2}$  in. wide—and cut the bristles down to 1 in. long. The shorter, more rigid bristles spread glue evenly and quickly. The different-width brushes let you pick the best brush for each job. When you use water-soluble glues, store brushes in a jar of water to keep them pliable. But, first apply a coat of rust-resistant paint to the metal ferrules to prevent rust from contaminating the glue.

## 6 SANDBAGGED

Sandbags are a great help when you glue large or uneven projects. They're flexible enough to weigh down irregular shapes that are otherwise impossible to clamp. When gluing large areas of plywood or veneers, pile sandbags in the center to ensure total contact between surfaces until the glue dries.

Fold a  $10 \times 24$ -in. piece of lightweight canvas in half to form a  $10 \times 12$ -in. bag. Sew sides closed and turn the bag inside out. Add sand until it's three-quarters full, fold the top edges in  $\frac{1}{2}$  in. and sew the bag closed.



Gluing uneven projects, such as this tambour door, is easy with several sandbags.

## 7 MASKING-TAPE STOP



Try this masking tape stop on a paper trimmer when you cut sheets of sandpaper.

This simple idea provides a temporary stop for a radial-arm or table saw.

Make a  $\frac{1}{4}$ -in.-deep cut into a roll of masking tape ( $\frac{1}{2}$  or  $\frac{3}{4}$  in. wide) with a razor knife. Position a piece of the  $\frac{1}{4}$ -in.-thick tape on the fence or table at the desired distance from the blade. Abut the wood to the stop on each cut to produce identical-length pieces without measuring each one. You'll find many shop uses for this stop, such as cutting sandpaper on a paper trimmer. To reuse the stop, peel off the bottom layer of tape to reveal a clean adhesive surface.



## 8 IDENTIFYING DOWEL JOINTS

Correctly identifying and aligning dowel joints can be pretty tricky. Try this method to avoid misaligned joints when you build a frame.

After you cut the frame's stiles and rails, lay them out on a workbench and clamp the frame square. Draw a pencil line across each joint using a try square to indicate the dowel locations. These marks will be used to align the doweling jig when boring the dowel holes. Identify each mating piece with a letter to help you match the joints correctly during final assembly.



Mark for dowels with a try square. Initial each mating piece with a letter.

## 9 DRAWER KNOB AND PULL JIG

This homemade jig provides a quick, accurate way to mark knob or pull locations on cabinet drawers and doors.

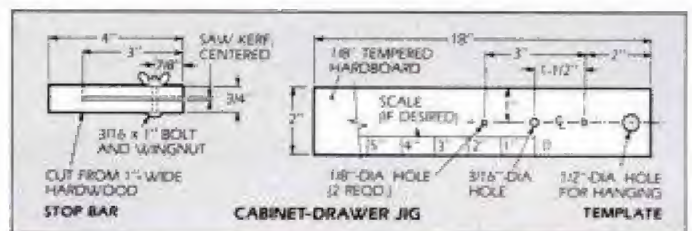
To install drawer hardware, first mark a centerline lengthwise on the drawer face. Hold the jig with the stop bar against the edge of the drawer face, and align the centerline through the template holes. The  $\frac{3}{16}$ -in.-dia. hole is

for laying out knobs. The two  $\frac{1}{8}$ -in.-dia. holes are for laying out pulls. Note that the two pull template holes are 3 in. on center to accommodate standard hardware. You can easily alter the template to lay out hardware of all sizes.

To install hardware on cabinet doors, hold the stop bar on the top of the door, and keep the template edge flush with

the door edge. Mark and bore the mounting holes.

To assemble the jig, pass the template through the stop bar's saw kerf, and tighten the wingnut. The distance from the template holes to the stop bar should equal the distance from the desired mounting hole to the top of the door, or to edge of the drawer face.



This jig is used to install knobs or pulls on doors and drawers.

## 10 CENTER FINDER

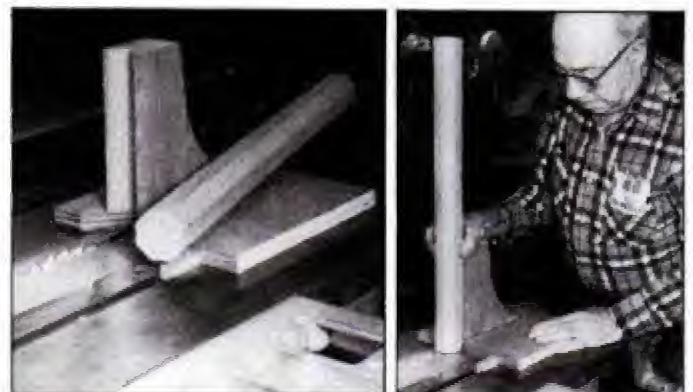
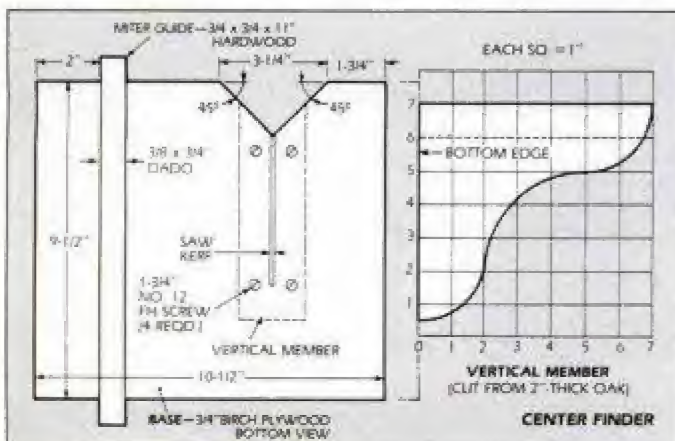
Use this homemade jig on your table saw to locate the centers of wood stock for lathe turnings. The jig's hardwood miter guide rides in miter grooves machined in the saw table top. Hold the lathe turning stock firmly on end in the 45° channel of the vertical member; pass the jig over the blade scoring the stock end. Rotate the stock 90° and

score the end again. Intersection of the two saw kerfs is exact center. Repeat on the other end. At exact center points the lathe's headstock and tailstock centers hold the wood for turning.

When finding the center of hardwoods for lathe turning, kerf the headstock end of the wood  $\frac{1}{8}$  in. deep; the tailstock end  $\frac{1}{16}$  in. deep. For soft-

woods, kerf the headstock end  $\frac{3}{16}$  in. deep; tailstock end  $\frac{1}{8}$  in. deep.

Construct the jig with the dado and the vertical member parallel to the saw blade. Glue the hardwood miter guide into the dado. Countersink vertical member mounting screws so they will clear the saw table. Apply three coats of polyurethane varnish. **FM**



Find the center of any shaped stock. Blade height is exaggerated for clarity. Hardwood miter guide rides in saw table grooves.



# Make This Squirrel-Proof Bird Feeder

**H**ere's a bird feeder that solves two common problems: It drains off rainwater, and it keeps squirrels from stealing the feed.

Basically, the feeder is a frame with wire screen stapled to the bottom to hold the seed. This permits rain to drain right through and lets the seed dry out quickly when warmed by the sun.

Half-inch hardware cloth, stapled across two sections of the top, effectively frustrates the squirrels. Birds can poke their beaks through the wire mesh to get at the feed, but the squirrels' paws are too big to gain easy entrance. There's a lot of entertainment in watching the antics of a squirrel as he tries to maneuver seed up through the mesh



*Birds of all kinds flock to feeder. Here, warbler enjoys a dinner that squirrels are unable to steal, while a chickadee on a suet spike savors peanut-butter mix.*

with his paws, nose and tongue. Since even these squirrel thieves deserve some consideration, we left one section of the feeder open at the top just to feed them.

The feeding post has a dowel with

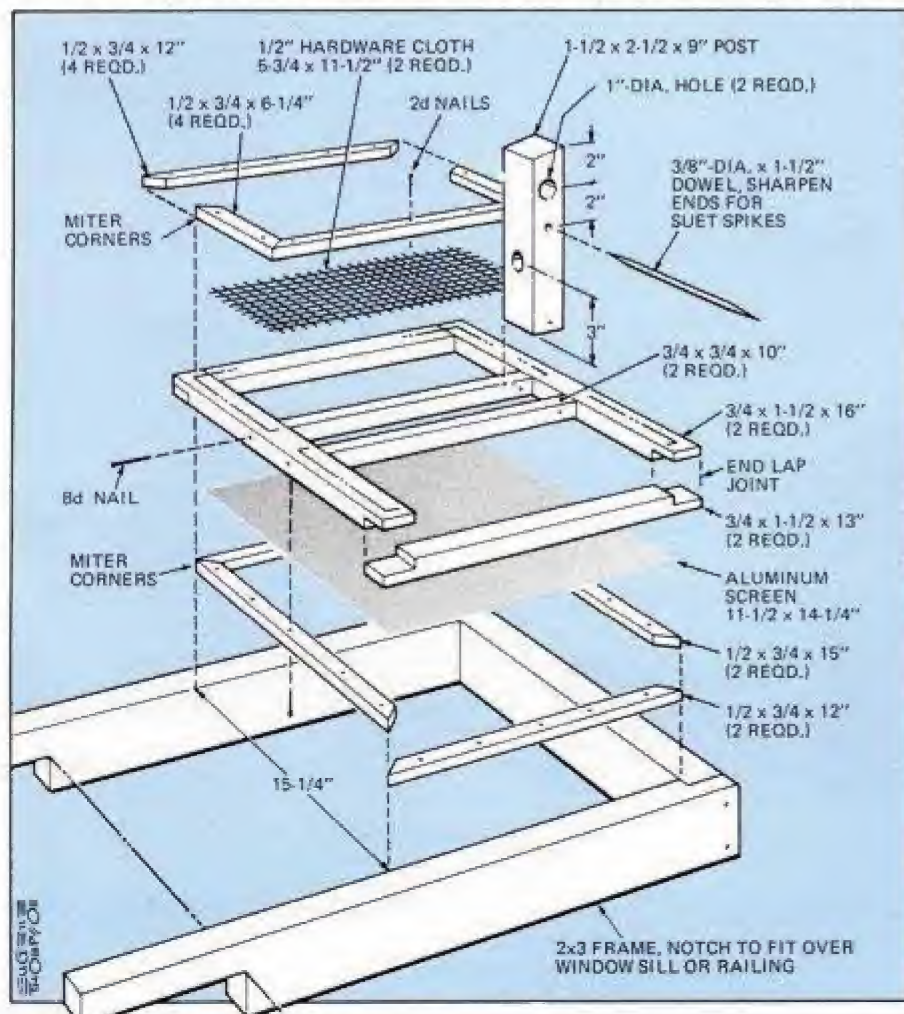
two sharpened ends through it. The sharp points make it easy to hang suet, a favorite food of most birds. The two 1-in.-dia. holes drilled through the post are for a peanut-butter mix that's an avian gourmet's delight. Here's a well-proven recipe for the mix:

Melt 2 cups of lard in a saucepan. Pour into a 3- or 4-qt. mixing bowl. Stir in 1 cup peanut butter and blend evenly. Stir in 2 cups corn meal, 2 cups flour and 2 cups mixed birdseed. Let mixture cool. Pack the mixture daily into holes in the feeding post. Store the mix covered, but don't refrigerate.

The dimensions and design of the feeder are not critical, except that the feed-holding sections should be  $\frac{3}{4}$  in. deep and should be covered with  $\frac{1}{2}$ -in. hardware cloth. The 2x3 mounting frame can be made almost any length, but it may require some bracing (not shown) for additional stability.

—Cliff Hicks

*Feeder and mounting frame were made from one 8-ft. 1x4 and one 8-ft. 2x3. We used redwood, but pressure-treated lumber will do, too. Use waterproof glue in joints.*



*Easy removal means easy cleaning; simply turn it over to shake out old feed. For a more thorough wash, hose out screen from underside. Mitered screen retainers position feeder in mounting frame.*



# WORKSHOP MINICOURSE



## About driving nails

**1** The usual method for starting a nail is to grasp it between your thumb and index finger and to tap the head lightly once or twice. Once the nail is seated in wood, the holding hand can be removed. The nailhead should be struck squarely by center of hammer's face (dotted line).

Driving a nail seems to be a natural act for human beings to perform. To help develop motor skills, one of the first toys many of us give our children is a mallet, various-shaped pegs and a board with holes to match. Yet, there are techniques to be learned to use a hammer correctly and safely.

For conventional nailing there is relatively little to master: **1.** You start a nail with several light taps, then, **2.** you remove the nail-holding hand and drive home the nail by hitting its head squarely with the center of the hammer's face.

Carpenters know that since the wrist is the pivot point for the hammer swing (arc), it must be adjusted downward continually as the nail is being driven home. Failure to do so will result in glancing blows to the nailhead.

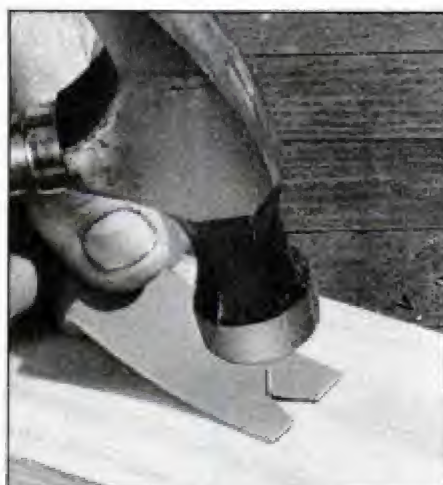
But what about more complex nailing tasks? For example, when framing a wall from a ladder you must often reach out with your hammer hand to drive a nail while you hold onto the ladder with your other hand. Here, you can use either of the stunts shown in the last two photos. Do-it-yourself writers generally suggest the hold-the-nail-in-the-claws technique, then erroneously show it being done with the hammer hand on the handle. Don't believe it. There is no way that a nail—simply forced between hammer claws—will stay put. If you do try this method, grip hammer and nail as shown here.

However, most carpenters (myself included) prefer to use the nail-against-the-cheek method pictured in the fifth photo. Here you simply place nailhead against hammer cheek, flank it with fingers grasping the hammer as shown, and "punch" the nail point at the spot you want to drive it. Done correctly, one punch will seat the nail in the wood.

One final word about nails, and driving them. Many home carpenters hold nails in their mouths, because it expedites the task on a multinail job. Don't start this habit if you're a beginner, and try to break it if you already do it. Today, many nails are coated, and the galvanizing, resin or other coatings can cause a toxic reaction. **PM**



**2** One way of starting a small nail or brad is to grip it palm side up, as here. This way, hefty knuckles are out of way and you have a clear shot at brad.



**3** Another way to hold a small brad is with a V-cut in a cardboard scrap. Method works for several brads, then V-notch becomes too big to hold nail up.



**4** With nail between claws, hold the nail with hand as shown. Some books show a no-hands start for this technique. That's nonsense—you must hold it.



**5** To start a nail in hard-to-reach spot using one hand, author prefers nail-head against hammer cheek, and grip shown. Nail is then "punched" to start it.



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2 Itasca Phasar

3 Sportscoach

5 Champion  
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6 Fan Coach 32

4 Sportscoach interior



## MORE-MILES-PER-GALLON

# RVS

Camping vehicles are making a comeback, with new looks and fuel economy two big reasons.

BY BILL McKEOWN RV EDITOR

**T**here have been a lot of turns and rough spots in the roads to recreation recently, and the manufacturers of family fun vehicles have had to change routes. Some makes pulled over into the slow lane or off the road for good. Others have been forced to do a U-turn in design and construction. But now a few brands are getting back up to speed and are rolling along again.

When low miles per gallon of fuel, high prices and interest rates, and the recession economy downshifted RVs into low-gear sales, the industry had to take a hard look at its vehicles. And they've come up with some interesting methods to improve performance without running up costs.

Winnebago's answer is to go lower and sleeker. One way to cut down the wind resistance that burns up fuel is to make a smaller, more streamlined vehicle. But that can result in a low-ceiling rig that makes it necessary to get dressed lying down and to move about inside in a crouch—rough during a rainy day at a campground, when you can't go outside to stretch. The solution, Winnebago engineers at Forest City, Iowa, found, was to go to front-wheel drive and lower the floors of their new Le Sharo motorhome, Centauri van and Itasca Phasar. That way, there is still 6 feet of standing headroom and a step up of only 10 inches from the ground.

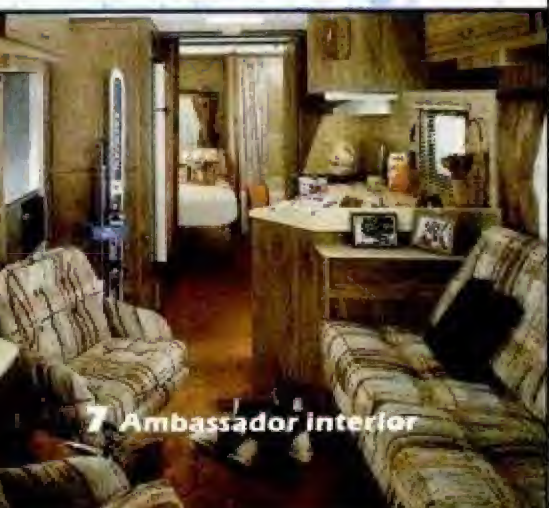
Power comes from a Renault two-liter diesel that has proved successful in Europe. A special unitized body chassis assembled by Winnebago, called H-body, employs a drive train and some sheet-metal parts used overseas by Renault in its Traffic van. Ron Haugen, president of Winnebago, told us that eventually refinements such as turbocharging, automatic transmissions and the option of gasoline or diesel engines may be offered. But the 22 to 24-plus mpg fuel economy of the Centauri van and Le Sharo and Phasar motorhomes already seems to give Winnebago a head start in the economy performance sweepstakes.

Additional big names in this year's RV lineup include Coachmen, Fleetwood, Holiday Rambler, Jayco, Starcraft and Yellowstone,

### 8 Holiday Rambler Ambassador 33



*Smaller than Warrior and with 24-mpg diesel efficiency, Phasar (1 and 2), like Winnebago Le Sharo and Centauri, tops line. New Sportscoach (3 and 4), from Coachmen, offers luxury accessories. Champion Titan (5), TranStar and Champion motorhomes have been redesigned. Fan Coach travel trailers come in six lengths from 23 feet to Fan 32 (6). Ambassador motorhomes (7 and 8) come in seven models from Holiday Rambler.*



7 Ambassador interior



\$1,254.00 incl. page 116



**Sunline Solaris**

Up to 20 miles per gallon is claimed for Sunline Solaris with Toyota chassis from Sunline Coach, Denver, Pa. The lightweight, 17-foot, micro-mini motorhome can sleep four: two in a convertible dinette installed front or rear, plus a cab-over double.

among others. Several of these have become parent corporations for familiar names like Shasta, Fan, Sportscoach, Viking and Midas in the Coachmen camp; and Prowler, Wilderness, Cimarron, Terry, Taurus, Pace Arrow, Southwind, Tioga, Jamboree and Resort among the Fleetwood brands.

Larger companies in the field have learned the importance of after-sale service for their products, and owners have discovered that the big established builders that have weathered recent recessions are likely to be around when spare parts inevitably become necessary.

Latest recreational rigs are more rugged, with steel and aluminum frames taking the place of wood in many models. All manufacturers are looking at new ways to cut windage and weight. The heavy shoebox-shaped RVs of the past are out. They waste too much gas, look unattractive and won't sell.

Vans, slide-in campers and travel trailers with pop-up tops that raise for headroom at the campsite and lower for towing or rolling down the road, are still popular. Refinements like bathtubs

*(Please turn to page 116)*

Rated one of roomiest of compacts, 22-foot Falcon 220, from International Vehicles, Bristol, Ind., will sleep six in three double beds, and boasts luxury of a bathtub with shower, plus standing headroom throughout the van.



**InterVec Falcon**

**Cruise Master**

**Excalibur**

**Cruise Air**

**Swinger**



Improved aerodynamics are reported to increase fuel efficiency of latest motorhomes from Georgie Boy, Edwardsburg, Mich.

Chevrolet 6.2-liter diesel engines are available for four models shown. All feature light and streamlined bodies.



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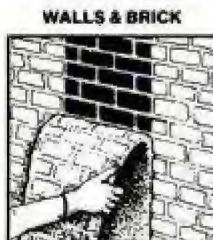
### SO EASY EVEN A CHILD CAN DO IT!

Called 'Peel-Away', this new wonder-formula has been officially registered with Gov't. patent offices throughout the World. It is completely odorless—completely safe! Reacts only with paint, varnish, lacquer or shellac . . . nothing else! So you can use it on even finest furniture, precious art frames, why even delicate wicker or valuable painted-over marble. In fact, it is so safe, so gentle, it is used by London's British Museum and world-famous art galleries to strip old art frames and century-old paneling. Even used by antique dealers to strip down priceless furniture treasures for restoration. Yes, 'PEEL-AWAY' literally lifts away every last layer of old paint even from hard-to-get-at places such as impossible-to-reach windowpane corners . . . grooved molding . . . finely tooled woodwork, etc., etc.

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Oyster Tent



For penthouse tenting with standard or compact car, van with roof rack or pickup with cargo bars, Oyster from the Oyster Tent Co., Ann Arbor, Mich., rides with minimum windage folded, opens into large double-bed tent that cartops or can be set up on ground.



Sunrader FG-210

Even a small Toyota chassis can carry a micro motorhome, and Sunrader FG-210 from Gardener-Pacific, Vallejo, Calif., offers fuel-efficient recreation; four floor plans are available. The Trans-Awn 2000 side awning is an optional accessory.

are now appearing in RVs as small as International Vehicle's 16-foot, compact four-sleeper motorhome Horizon van and its Falcon 22-foot stretched van, which sleeps six. Rigs this size can combine the maneuverability and convenience of a station wagon or van, plus the full headroom and sleeping accommodations of a motorhome. And optional in Shastas is a Lift-A-Way installation that acts as an elevator for any family member who needs to board the motorhome in a wheelchair.

Among the big rigs—the fifth-wheel and park-model travel trailers that take up residence for months at a time in a resort area—there are innovations to stretch the walls.

Slide-out sections that can almost double the size of a living room or bedroom are options for some of the largest models. A few are designed so that once a trailer park is picked for the season, the complete back wall can be extended.

Latest models have more than the comforts of home.

PM



# HOW TO DRILL A BACKYARD WATER WELL

BILL HARRINGTON

I've been drilling water wells in Oklahoma for about 15 years.

When I first saw the ad that claims a man can drill his own water well with a Hydra-Drill, I was extremely skeptical. I thought to myself — how can that be? That's impossible. It takes a big engine, it takes a big rig to drill a water well. But my curiosity kept nagging me, so I sent off for the information.

My daughter's boyfriend is a well driller over in Arizona. I showed him the Hydra-Drill literature. His first reaction was "I don't believe it. I don't believe a 3 hp. drill can do the same thing my 100 hp. drill does." But the more I studied it, the more it sounded like a good idea.

## A WATER SHORTAGE

Another thing on my mind was the drought. We're having the worst drought here since the dustbowl days back in the '30s. A lot of towns around here all the way over to Tulsa are running short of water, and some of them have started water rationing. It's very hard on a lot of people, but business is good for well drillers. I'd been thinking about buying another drill and putting my son Robert in business. He's 18 years old, and he'd never worked on a drill before. I decided he could learn with a Hydra-Drill.

## EASY SET UP

Now when I started out in the drilling business 15 years ago, I had a big drill that just about worked me to death. Later, I got a rotary drill. It was easier to operate, but it took a day and a half to set up and drill a well in this area. You can't imagine how I felt when they delivered our Hydra-Drill. It was so compact, very simple. Robert and a young friend of his took it out and set it up in just a few minutes.

## OUR FIRST HYDRA-DRILL WELL

The day we went out to drill our first well with the Hydra-Drill, I was all fixed to work with the boys and give them plenty of advice. However, it was a very hot day — about 100 degrees — and once they got started drilling I could see they didn't need me standing right there, so I went over and sat down in the shade of a tree. In about an hour, they came over and I asked them if they were taking a break, and they said no, they had just finished drilling the well.

It was amazing. They had drilled down forty-seven and a half feet and hit a layer of beautiful, coarse sand — the kind that produces good water and a lot of it. They had drilled that well in less time than it takes me just to set up my big drill.



PHOTO BY TONY JACOBY

Later, I figured they had drilled that well with less than one gallon of gas. My big drill would burn up at least fifteen gallons of gas for that job!

## MAKES MONEY

The next day we drilled a well 115 feet deep through rock, and it went fast too. The Hydra-Drill really takes the hard work out of it. It's fast and economical, and that's what it takes to make money drilling wells.

Also the Hydra-Drill is so portable we can set up and drill anywhere. In the past, I've lost out on some jobs because people were afraid my big drill would tear up their yard. With the Hydra-Drill, we can drill without tearing up anything or making a mess. This is a big selling point to my customers.

I'm just grateful to have this Hydra-Drill. I've got my son started in a good business he can make some money with. If I had bought another big drill, it would cost thousands of dollars, and that is just ridiculous because the Hydra-Drill does the job just as good. In fact, I figure we earned enough to pay for the Hydra-Drill the first week. From here on, we're in the blue chips.

## GOOD, PURE WATER

I believe anyone can drill a well with a Hydra-Drill. Even if they just wanted to drill their own well, they'd save money. It's simple and it's easy if they just read the instructions. And the best part about it is that you get good, pure water without all those chemicals in it, and the water costs you, say 5 cents for a thousand gallons. You certainly can't buy city water for that. And it's a great feeling to have all the water you want even when

the city is rationing water to everyone else.

The man who invented the Hydra-Drill really knew what he was doing. Modern technology is a wonderful thing, isn't it?

*NOTE: Readers can get a big, fully illustrated information kit on the HYDRA-DRILL including a booklet, "How to Drill Your Own Water Well." The information kit is available free, without obligation. Requests should be addressed DeepRock Mfg. Co., 777 Anderson Rd., Opelika, Alabama 36802.*

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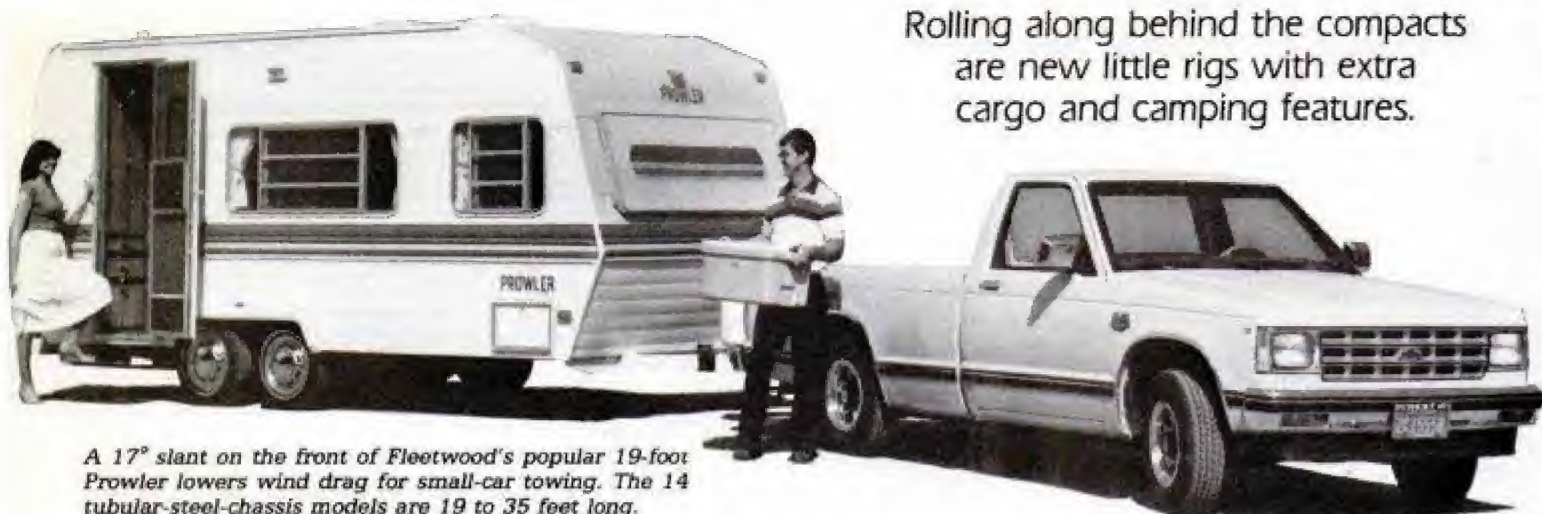
©1983 DeepRock Mfg. Co.





# TINY TRAILERS FOR

Rolling along behind the compacts are new little rigs with extra cargo and camping features.



A 17° slant on the front of Fleetwood's popular 19-foot Prowler lowers wind drag for small-car towing. The 14 tubular-steel-chassis models are 19 to 35 feet long.



Camping trailers still offer convertible convenience. Jayco, in Middlebury, Ind., provides seven floor plans in open lengths from 17 to 24 feet, plus six new J-series economy models, 11 to 15 feet long for towing, that can sleep up to eight.



Coleman's compact utility trailer, named the Caboose, can stow on end in little space. Other mini-models include PackHorse II and multipurpose VersaTrailer.



Happy Trails is a one-wheel cargo carrier from North Star Products, Hardwood, Mich. It's reported easy to back and garage while attached to compact car.

**S**mall rigs let you bring more comforts of home along to bargain campsites. Some new trailers have been designed for quick-change work or play assignments, as well. Camping trailers (tent trailers) are more versatile than ever, and new, tag-along luggage trailers now let you pack all the gear normally stowed in the trunk of a standard-size sedan.

Examples of the growth in small trailers are the new rigs from Coleman Camping Trailers in Somerset, Pa. This division of the Coleman Co. has six deluxe and three economy tent trailer camping models, plus four more mini-trailers for cargo, camping gear and even camping out. That quartet consists of the VersaTrailer, Coleman Caboose, one-wheel PackHorse and PackHorse II.

Many other builders have joined the minitrailer market. Models like Shoreline Trailers' Li'l Pup, single and two-wheel Car-Go units from Agri-Fab, Holsclaw's Compact, Bock Products' bolt-together kit BT Drag Star, the Trunk Trailer from Allied Aluminum and the Time Out tent camper from T.O. Corp. are among them. Some, like the Time Out and Shoreline Cargo, are light enough to trail behind all but the smallest motorcycles.

Pop-up tops with tent-type sidewalls are another way to get headroom, yet shrink wind resistance on the road. The Valor fifth wheel, a 21-footer from New Paris Enterprises, raises the roof for two extra feet. Bonanza Traveler's Bandit and Sun-Lite slide-in pickup camper do the same. Larger Hi-Lo travel trailers telescope up and down.

Aluminum and lighter plastic are being used in rigs of all sizes. Each weight and windage savings cuts gas costs, as well. **PM**



# ECONOMY TOWING



With a hitch weight of only 84 pounds and axle weight of 812, Starcraft's new AeroStar 17 can sleep five and is 16½ feet long when opened, but closes down to 12½-foot length and 45-inch height when ready for towing.



Especially designed for towing three-wheel and all-terrain cycles, Tuff 'N Lite trailer is from Unique Function Products, San Marcos, Calif.



With 50 percent of new cars being made with front-wheel drive, U-Haul dealers are providing a rental tow-dolly for trailing a car behind your truck or motorhome. The dolly acts as a substitute front axle.



For camping without pitching a tent, Jayco's European-style Jaytiki unfolds down and back in 20 seconds from trailer to four-sleeper.



Even a motorcycle couple can tow a two-bunk trailer (left) from Continental Industries, Davison, Mich. The larger Travelite model (right) sleeps four and can be towed by compact cars. Both open for 6½-foot headroom.



Coleman's One-Wheel PackHorse is 137 pounds, but can carry 400. Add-on stand and swivel-wheel lock converts it for back-yard use.



Hardwall Nordic camping trailer, new from Viking RV division of Coachmen, can sleep up to eight and opens from a 16½-foot road trailer to a 20-foot camper with a pushbutton electric lift system for quick setup.



\$1,042.00 incl. page 122

# New For Spring Fitting Out



**F**or boat owners getting ready to launch their rigs in the North, or haul out for refurbishing in the South, the latest hardware and accessories come in more durable metals and plastics for longer life with less maintenance.

## Aluminum hulls resist corrosion

Light enough to be towed easily with a mini-pickup, Starcraft's 15½-foot Bass 150 has a one-piece hull bot-

tom made of 5052 marine aluminum alloy that can resist the attacks of salt water and electrolysis. Long-wearing, marine-grade hardware and grass carpeting for the casting platforms should limit maintenance.



## Add-on stabilizer

To take the tipping out of canoeing, plans for a clamp-on Steady Fin are \$3 from Seamaster Boats, Drawer T, Duxbury, Mass. 02332.



## Self-tailer, self-cleater

A grooved rubber flange that fits on most winches, the Wincher is a self-tailing, cleating device from Watski, Box W, Charlestown, N.H.



## Keel-hauler cleaner

A bottom-scrubber for boats, the Hullmate requires no haul-out. With a clean hull, you'll cut drag. The synthetic scrub pad is \$30. It's available from LaMar Design, 3407 Harmony, Troy, Mich.

## Uncluttered lighting

For fishing boats whose decks must be unobstructed, new Perko 1612 combination side light can be removed and socket sealed with a waterproof cap. USCG approved, it's \$18.50 at Perko dealers.



(Please turn to page 122)



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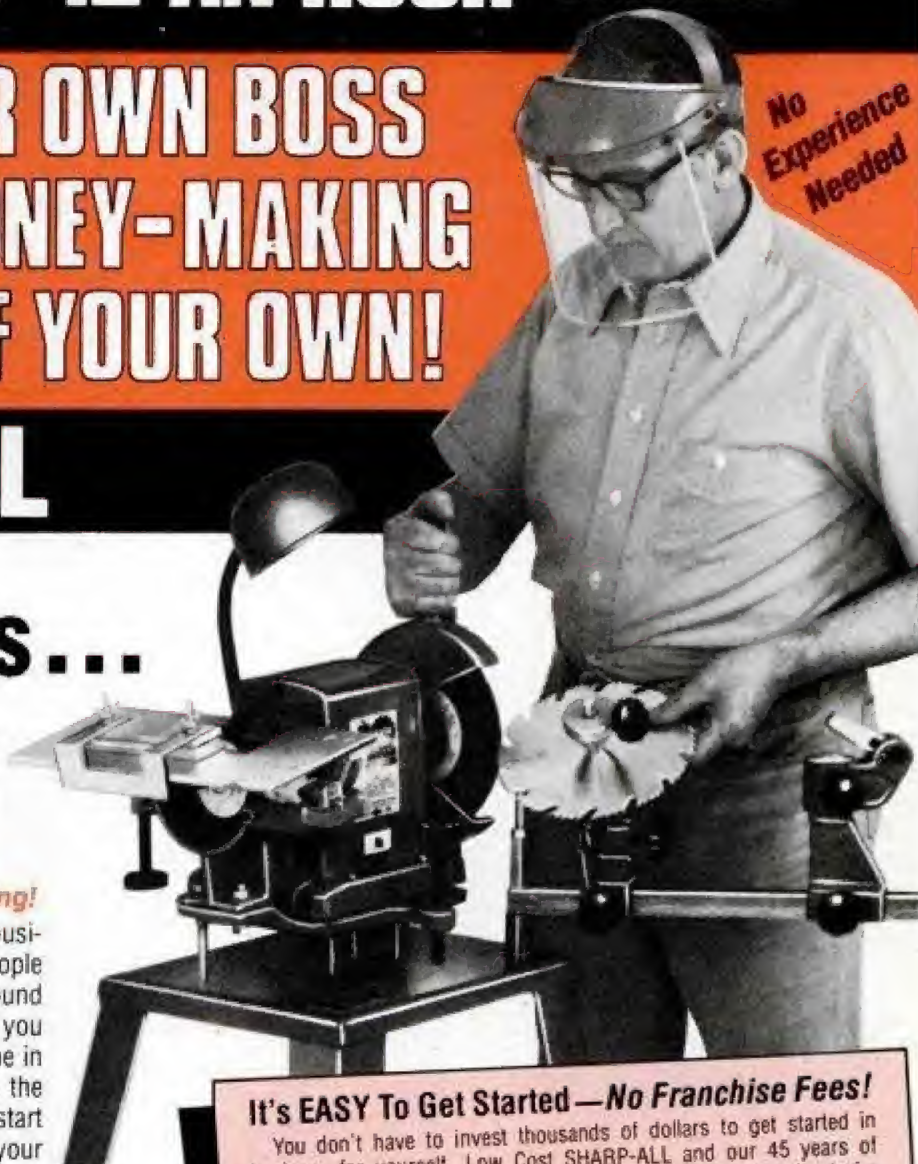
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### Shock-absorber harness

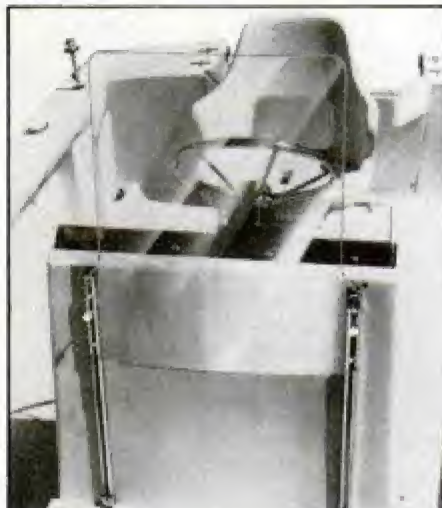
The Ocean Sailing Flotation Harness from Stan Loudon Products, Toronto, Ont., combines life-preserver flotation of foam with shock-absorbing safety harness; it's \$170.



### Center seat for solo canoeing

Instead of sitting alone in the stern while the wind swings the bow around, or kneeling amidships, a paddler can build an inexpensive

drop-in seat with adjustable footrest from designer Bob Whittier's plans. They're \$3 postpaid from Seamaster Boats, Duxbury, Mass.



### Adjustable windscreen

New from N.A. Taylor, Gloversville, N.Y., is curved windshield for fishing boats that can move 23 inches up or down.



### Battery monitor

Electrical Systems Monitor gives battery condition with lights and buzzer. It's \$30 from Attwood/ESM, Box A, Lowell, Mich. 49331.



### Handheld signal

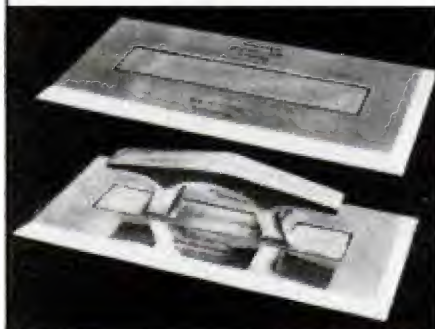
Red meteor distress launcher fires two simultaneous signals that are visible 30 miles at night. The Twin-Star, from Kilgore, Toone, Tenn., is U.S. Coast Guard approved.



### Sounding off afloat

Loud enough to signal at 125 decibels, the handheld Sea Guard has replaceable canisters. It's \$14 from Attwood hardware dealers.

**Disappearing cleats**  
Gunwale-mounted cleats and chocks, \$30 from Meachem Marketing, Sarasota, Fla., can drop out of sight so lines won't snag.



### Handheld compass

Rubber-collared and worn on a lanyard, the Mariner's Compass, \$85 from E & B Marine Supply, Box 747, Edison, N.J. 08818, is used by America's Cup yachts. **PM**





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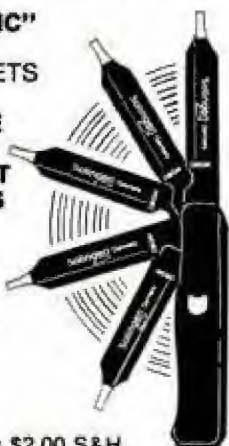
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## ASSEMBLY-LINE GENES

(Continued from page 95)

own needs," explains Beckman's Pa-  
mukcu. Many laboratories, he notes,  
build their High Performance Liquid  
Chromatography (HPLC) sets out of  
components.

All HPLC systems do one basic thing:  
they use a column of absorbent fluid to  
separate the molecules of a protein by  
weight, electrical charge or other spe-  
cific property. Not only does this help  
sequence a protein, but it also allows  
investigators to identify even slight  
variations between two proteins.

The genetic engineering business  
has truly come of age. In addition to all  
the high-speed components, the indus-  
try has entire factories dedicated to the  
production of a specific protein. New  
Brunswick Scientific, for example,  
makes a cell-culture system for the pro-  
duction of interferon.

More than 100 gallons of cells can be  
produced in a single, computerized sys-  
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several factors, including the amount of  
interferon coming from each cell. The  
chemical broth is mixed and filtered in  
250-gallon (1,000-liter) tanks before  
moving on to tanks filled with bacteria.  
After the desired number are grown,  
the broth is piped to suspension tanks  
to let the dead cells separate from the  
chemicals, which are then poured off.  
Finally, the cells are put in a centrifuge  
to spin out the interferon.

## Slave race

Is the new genetics just too good to  
be true? A presidential commission late  
last year announced its findings: that  
the day is far off when mad scientists  
will be able to clone a slave race out of  
"engineered" apes whose genes are  
rearranged to let them perform menial  
tasks. Still, the report cautioned, the  
genetic engineering revolution is here  
to stay, and some mechanism should be  
set up to watch it.

Weeks after the report was released,  
scientists at the Carnegie Institute of  
Washington announced they had bred  
red-eyed fruit flies from brown-eyed  
parents through genetic manipulation.  
They used pieces of DNA to carry the  
proteins for red-eye color into fertilized  
brown-eyed fly embryos. That's a mis-  
sion unanticipated in the presidential  
report.

Just to be on the safe side, Rep.  
Albert Gore (D.-Tenn.) has ordered  
hearings on the genetic industry for the  
current session of Congress. Gore has  
expressed concern about the rapid  
advancement of genetic engineering  
without appropriate monitoring. Thus,  
we can expect to hear a lot this year  
over an issue that has kindled our best  
hopes—and worst fears.

PM



### 3 GARDENING AIDS

(Continued from page 105)

## 1 Potting bench

The potting bench is adapted from one used by Bob Thomson, host of the *Victory Garden* TV program, aired nationally on PBS. The simple but sturdy bench is built to withstand strenuous daily use. We show plans for a smaller version to suit a home gardener's needs and space limitations. We also added a top shelf for parking flowerpots during work sessions and a garden-tool board.

The bench is framed with pressure-treated 2x4s; work and storage surfaces are 1x6s. Or you can use common pine for the frame and work surfaces. If you opt for the latter, coat all surfaces of these members with a wood preservative, such as Woodlife, several hours before you assemble the parts. Give the bench a second coat.

We used exterior plywood for bench shelf, sides and back. The board to hold tools is perforated hardboard fitted with tool-holding hardware.

Cut frame members for the deck. Hold parts together temporarily with bar clamps. Check corners with a large square; adjust if needed. Then bore pilot holes for nails to prevent the wood from splitting. Use resorcinol glue and nails to assemble parts.

Cut the 1x6s for the work surface and the lower storage shelf to length. Cut the notches for the legs in two shelf members. Bore pilot holes and nail the work top in place.

Cut the plywood sides and back. Notice that the sides taper in height from 21 in. in back to 7 in. in front. Glue and nail the back and sides to the bench top and to each other.

Cut the upper shelf to size and bore the optional flowerpot holes. You can make these using a fly cutter in the drill press, but clamp the shelf firmly to the press table on both sides of the cutter. Or you can make the circular cuts with a sabre saw.

The bench legs are cut to length and the notches are cut. You can make the internal notches with a sabre saw and chisel. Or use a radial-arm saw in this manner: Mark for notch width and depth on the face of the leg and align the notch (waste) area with the saw blade. Adjust the blade to notch depth. Make successive overlapping passes with the blade. Clean using a chisel.

Rest the bench top bottom side up. Position the back legs; bore pilot holes and glue and nail the legs in place.

Rotate the bench onto its front assembly and install the front legs in the same manner. Let the glue dry for 24 hours. Next, cut the lower frame members to length. Test-assemble using clamps and bore pilot holes after checking that the frame is square. Then

secure the parts with glue and nails.

Finally, cut out parts for the tool board. Glue and nail the frame together with 4d nails and set it aside. Bore lead holes and fasten the cleats to the legs with 10d nails. Bore lead holes and fasten the perforated hardboard to the bench with 6d common nails. Apply veneer edge tape to exposed edges, if desired, using contact cement.

## 2 Lettuce shader

Our lettuce shader does a perfect job of partially shading lettuce from the sun. This minimizes leaf burn, and produces

a more bountiful crop. If you build it of No. 2 common pine and treat it with wood preservative, it will last for years.

Since the slat assembly is not attached to the legs, you can store it nearly flat against a wall.

The shader on page 105 has 1x2 slats spaced 1½ to 2 in. apart. These are secured by 6d hot-dipped galvanized nails to a base of 2x3 rails and end pieces. Or you can use 2x4s.

Cut stake points on the legs as shown. Secure the legs to their cross members. Apply a wood preservative.

Note: A pair of shading units can

(Please turn to page 126)

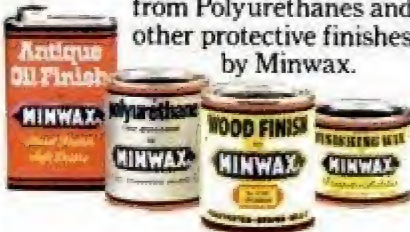


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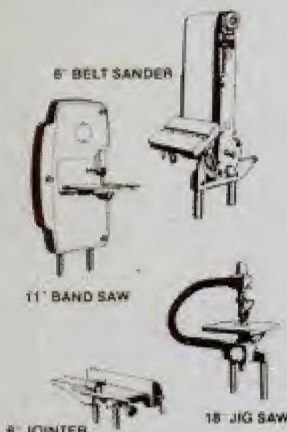


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## 3 GARDENING AIDS

(Continued from page 125)

share a common (center) leg unit if each shaver is set to occupy just half the crosspiece width. This leaves a lip upon which the next shaver can rest.

## 3 Caterpillar cloche

The caterpillar cloche adds a season extender to your garden—and it costs less than \$25 to build. You can assemble it in several hours with tape measure, hacksaw, paintbrush, scissors or knife, and hammer.

Materials you'll need include: 1/4-in.-dia., hot-rolled steel bar; 4- or 6-mil polyethylene plastic; rustproof paint; two 16-in. wood stakes; and twine. Steel bar is sold in 20-ft. lengths (check the classified directory under "Steel distributors and warehouses"). The cloche shown covers a 40-in. wide × 12-ft. planting bed. You'll need four bars to cut ten 80-in. lengths. For beds of other dimensions, allow two arched bars for every 3 ft. of garden bed.

The cloche shown requires a 4 × 15-ft. piece of plastic. For other sizes, figure the amount of plastic by adding 3 ft. to the length of the growing bed. If your bed is wider than 4 ft., place two caterpillars side by side.

Use a hacksaw to cut the bars to 80-in. lengths. Clamp the bar stock in a vise to cut it. Apply two coats of rustproof paint to the bars using a paintbrush or old rag. Set aside to dry.

Starting at one end of the bed, mark the ground at 3-ft. intervals; you'll insert the steel bars at these points. Mark along one side of the bed, then along the other.

Push a steel bar for the lower level of bars about 6 in. into the ground. If it doesn't stand by itself, push it deeper. Straddling the bed, grip the top of the bar and slowly bend it toward the marked spot on the opposite side of the bed. Then push the end 6 in. into the soil. Repeat on the lower level bars.

Unroll and spread out the polyethylene plastic and cut it to size. Lay the plastic over the support bars. Gather the last 18 in. of plastic at one end and tie it with twine; repeat at other end.

Cut the wood stakes to 16-in. lengths. Tie one end of the plastic around a stake and hammer the stake in place. Then tie the plastic to the other stake and pull the plastic tight before hammering the stake.

Insert the upper level of steel bars directly over the lower ones, leaving 1/4 in. between them so the plastic slides freely for covering or uncovering.

The plastic skin should open roll-top-desk fashion. Pull the plastic up about 2 ft. at each support; then continue to pull it to reveal the entire bed.

PM

POPULAR MECHANICS • MARCH 1983

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rain or shine. Or so the car's designers tell us.

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(Please turn to page 128)

## THE VINTAGE VETTES

**A**nalyzing the Corvette is like trying to come to grips with John Wayne, Harley-Davidson or Coca-Cola. It's not a matter of right or wrong, better or worse. What we're talking about here is a symbol, an American institution, part of a shared national heritage, as immune to criticism as Motherhood and Old Glory. The Corvette simply is.

This automotive icon first came to us 30 years ago—in January 1953 at the Grand Ballroom of the Waldorf-Astoria, to be precise. The first prototype was the star of General Motors' annual Motordama auto show, and Dinah Shore posed for photos with George Montgomery, who proclaimed it snazzier than a Muntz Jet.

But, honestly, the 1953 Corvette wasn't much of a car. It had a Bel Air chassis shortened 13 inches through the middle, a hot-rodded Blue Flame Six of 150 reputed horsepower, a two-speed Powerglide automatic and a hand-glued, fiberglass, two-seater body. On the other hand, it was startlingly sleek for that time, and small—at least by American standards.

Only one thing kept this lackluster first-generation Corvette from also being the last. In 1955, Ford brought out the Thunderbird, which virtually guaranteed that arch-rival Chevrolet would field a competitor. Even though they sold fewer than 5,000 Corvettes from 1953 through 1955, Chevrolet simply had to keep plugging away.

Happily, Chevrolet was on a roll in the mid-'50s—the '55 through '57 Chevs are still cult cars among enthusiasts and collectors. Ed Cole was in charge of the division. Harry Barr and John Dolza were doing engines, Maurice Olley was doing chassis and Bill Mitchell was about to take over styling from Harley Earl. And, of course, Zora Arkus-Duntov, the father of the Corvette, was already blocking out his high-performance fiefdom.

In one of the great turnarounds of all time, this team transformed the hapless first-generation Corvette into the post-war American classic. For 1956, the car had a whole new body, with simple, timeless styling, a revamped chassis and, most important of all, well over 200 hp from the high-revving small-block V8. It

was a *tour de force* for everyone concerned.

The ultimate Corvette from a collector's point of view is a 1957—fuel-injected, 283-hp, 283-cu.-in. V8, four-speed, positraction, RPO 684 handling package, optional hardtop and Onyx Black paint with red/beige interior. Today, a collector can wisely spend \$25,000 for such a car and know he's got a bargain.

The 1957 Corvette was just about perfect, so, wouldn't you know it, it got a major redo for 1958 that made it heavier and uglier, without a compensating increase in quality or performance. The '59 and '60 were more of the same. The '61 and '62 were partially restyled by Bill Mitchell and got the rear end styling of one of the Corvette show cars of the era. The '62 was the first to get the 327 engine.

If there's a lost generation of Corvettes, it's these '58 through '62s. They're still comparatively inexpensive, but that's a direct reflection of supply and demand. Paradoxically, not only are the cars not as well liked by collectors, there are more of them not to like. Less than 10,000 Corvettes were sold in 1956 and '57 combined, while sales averaged over 10,000 annually the next five years.

The dividing line between classic and new-era Corvettes is 1963. Amazing as it may seem, there have only been two basic chassis in 30 years—the modified '53 Bel Air and the all-independent Sting Ray that's still in production. And discounting the Blue Flame Six of the first two years, just two engines—the small-block and big-block Chevrolet V-8s in various states of tune and displacement.

The '63 split window Sting Ray was perfectly timed. It was introduced just about concurrently with Jaguar's XKE and Shelby's Cobra, all three in the \$5,000, 150-mph, A-Production class. Corvette sales nearly doubled with the Sting Ray, and if there had been any justice in the world, they would have doubled again. The Sting Ray was that good.

The original Sting Ray was a styling exercise by Larry Shinoda which Bill

(Please turn to page 128)

## Log Splitter Parts



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Tie Rod*	3 1/2x24	1 3/8	50	909324	\$115
Tie Rod	4x24	1 3/4	74	909424	146
HD Tie Rod	4x24	2	78	909724HD	150
Tie Rod	5x24	2	100	909530	204
Welded Tee*	4x24	1 3/4	49	90424	132

\*These can be shipped U.P.S.

### Quality Gas Engines



HORIZ	HP	SHAFT SPECS	ITEM#	WT	PRICE
Tecumseh	5	3/4" Recoil	6051	40	\$130
Briggs	5	3/4" Recoil	6052	40	138
Briggs	8	1" Recoil, model 190432	6060	50	198
Tecumseh	8	1" Recoil, cast iron s/c	6081	50	182
Tecumseh	10	1" Recoil, cast iron s/c	6010	50	220
VERTICAL					
Briggs	5	7/8" Recoil, HD fly-wheel	7050	45	\$145
Tecumseh	5	7/8" Recoil, model	7051	30	125
Briggs	8	1" Recoil	7080	49	205
Tecumseh	8	1" Recoil, model VM80	7082	50	195
Tecumseh	8	1" Elec/Recoil, 12 volt	7083	55	239

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## CORVETTE (Continued from page 127)

Never have recycled beer cans been sacrificed for a better purpose. Upper and lower control arms, upper control arm shaft, steering knuckle, shock bracket, brake caliper, splash shields, retainers, the lot of it—all aluminum, forged or stamped. And if you look close-

er, you'll note the lack of a coil spring. The same filament-wound fiberglass rear spring, introduced in last year's car, has now also found a home at the front end. It's mounted transversely and bolted up in the center of the front

(Please turn to page 133)

## THE VINTAGE VETTES (Continued from page 127)

Mitchell fitted to one of Zora Duntov's Corvette Sebring SS chassis. Compared to other cars of the era, the Sting Ray looked like something from *Star Wars*.

It still does. Today, in 1983, Chevrolet could introduce the Sting Ray as a new car and set the world on its ear. The best of the production cars is probably the 1965. This was the first year for four-wheel disc brakes and the last year for the fuel-injected 327, rated at a conservative 375 hp. The styling was more refined than on the bulge-hooded, sweeping fendered cars that would come later. Yet you could still order knock-off alloy wheels.

The later Sting Rays were just about the ultimate in muscle cars. The 427-cu.-in. big block was nominally rated at 435 hp, but Chevy tuners reported seeing 560-600 hp on the dyno from stock V8s. In a 3,200-pound car, this gave a better power-to-weight ratio than anything except the 427 Cobra. The difference was that while Cobras were sold by the hundreds, Corvettes were sold by the tens of thousands. The Sting Ray was a world-class car. It was smaller, lighter, faster, quicker, smoother, quieter and not likely to leave you waiting for parts.

Today, the most desirable Sting Rays are either the very first split window 1963 coupes or the later 427s with horsepower that doesn't exist anymore. The ultimate would have to be the full-race L-88 427, with off-road side exhaust system, stuffed into a 1967 roadster.

Ironically, the '67 Sting Ray was never meant to be. The restyled car that debuted the following year was originally intended for 1967. This new body was derived from a GM show car called the Mako Shark. Like the Sting Ray, it was designed by Larry Shinoda. Unfortunately, the Mako Shark-derived car was heavier, bigger, softer and more expensive than the Sting Ray it replaced. At the time, Corvette enthusiasts considered the '68 Sting Ray a giant step backward.

Little did they know. There was still the racing L-88 engine and an aluminum block version called the ZL-1. The street 427 grew up to a 454, and the LT-1 350-cu.-in. small block, with mechanical lifters, was rated at 370 hp in 1970.

Then the emissions and safety regulations came into effect. Between 1970

and 1971, compression ratios dropped from 11:1 to 9:1 on the small blocks, and 12.5:1 to 9:1 on the big blocks. And the horsepower just galloped away.

Still, the Corvette kept selling as well as ever. It's just that the people who bought them changed dramatically. Up through 1967, the Corvette was bought by sports car enthusiasts. In any given year, 9 out of 10 buyers specified a four-speed manual transmission and manual steering.

In 1968, however, nearly 20 percent of all Corvettes were ordered with automatic transmissions, and by 1973, 60 percent were automatics. By 1978, only five percent were *not* automatics. By then, virtually all Sting Rays came with air conditioning, power steering, power windows and all the other accoutrements of personal/luxury cars.

Then there's the 1978 Indy Pace Car. This was the first Corvette in years to make it onto page one of the *Wall Street Journal*. The Pace Cars were the only modern Corvettes to be coveted by collectors, but for the wrong reasons.

Essentially a decal/paint treatment, the limited-edition Pace Cars became a phenomenon when investors started bidding the prices up over \$30,000 in the middle of 1978. Just as quickly, prices fell to under \$18,000, where they've stayed ever since. Realistically, Indy Pace Car prices will go up or down just as quickly as 1978 Corvette prices in general, but they'll stay about \$3,000 higher.

Which brings us to the first new Corvette in 15 years. The 1983 Corvette will be an instant collector's car. Not only is it strikingly pretty, but it's the first Corvette in over a decade with real performance. Besides, Corvette collectors always seem to attach special significance to the beginning of a new series. The '53, the '63, the '68, and now the '83, will always be worth a little more.

You can't judge a Corvette by normal automotive standards. It has survived a decade of emissions and safety emasculation with its performance image intact. And now that performance is back in style, Corvettes of all ages ought to be more popular than ever. Remember, this is an institution we're talking about here—America's Only Sports Car.

—Rich Taylor



## ELECTRONICS

### 3-D TV is here

**S**cientists generally believe that our ability to perceive depth is the result of our binocular vision. Now, challenging this concept, three University of Southern Carolina scientists have developed a technique that makes 3-D television, movies and slides a reality for everyone—even those with poor vision or vision in only one eye.

No special glasses, cameras, projectors or television sets are needed. And unlike traditional 3-D, the Visual Image Depth Enhancement Process (VISIDEP) produces images which have realistic depth and fullness, rather than exaggerated images which seem to leap outward.

Drs. Edwin Jones, LeConte Cathey and Porter McLaurin, experts in optics, electronics and media production, respectively, developed their novel approach by observing how a visually impaired person discerns depth. "We discovered that a one-eyed person perceives depth by moving his head and comparing a sequence of visual 'frames' from different angles," Dr. Cathey told PM. This concept was once considered impossible by physiologists.

VISIDEP simulates the optics of a one-eyed person by using conventional video equipment, plus a special encoding device which produces a time-sequence display of images captured from two different points of view on a single channel. Variations of the technique allow the South Carolina team to create 3-D images from slides, motion pictures and computers.

To produce the 3-D effect on a movie screen, early filmmakers shot each scene simultaneously with two cameras. Each camera was positioned to duplicate the angle at which the viewers' eyes would see the scenes. Next, the two films were tinted, one red and the other



Seeing single from double: You can simulate new 3-D effect by holding a small piece of cardboard (3x5 file card) on edge between these two slightly different images. Start with your nose touching the edge of the card and look at the photos. As you move the page slowly away from your eyes, the two images will merge, giving an illusion of depth.

blue-green, then projected onto a single screen by two projectors. Viewers wore special glasses with one lens tinted red and one blue-green to match the film's tint. This forced each eye to view a slightly different image. The resulting jumping-out effect, limited to the screen's center, could be seen only by a stationary audience.

VISIDEP has none of these restrictions. Once encoded, the image may be reproduced by any single conventional video camera, movie or slide projector. The depth moves into the screen rather than out toward the audience, making the image more lifelike.

Since VISIDEP can be applied to images generated by virtually any means—including X-rays, sonar, infrared or visible light, as well as from fiber optics—potential applications range from undersea and satellite transmissions to medical and computer sciences.

One particularly exciting application involves VISIDEP's ability to produce three-dimensional computer-aided design and manufacturing. With VISIDEP it's possible to display these images in three dimensions.

For nontechnical applications, the most immediate use of VISIDEP probably will be for televising commercials and sports events.

VISIDEP also may have an effect on some long-standing theories of perception. As Jones stresses, "Our development will force people to take another look at standard theories of how people perceive depth and, thus, how all of us learn."



In recording, twin-screen monitor (right) shows two images before encoding. Combined, they appear as one on single monitor (rear).



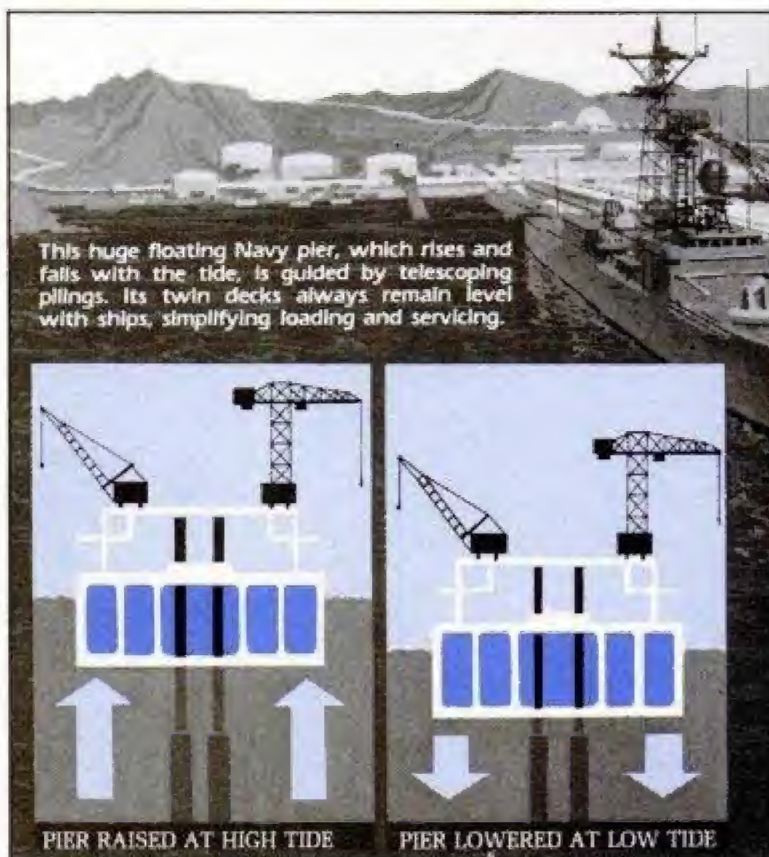
## MARINE

### Pier into the future

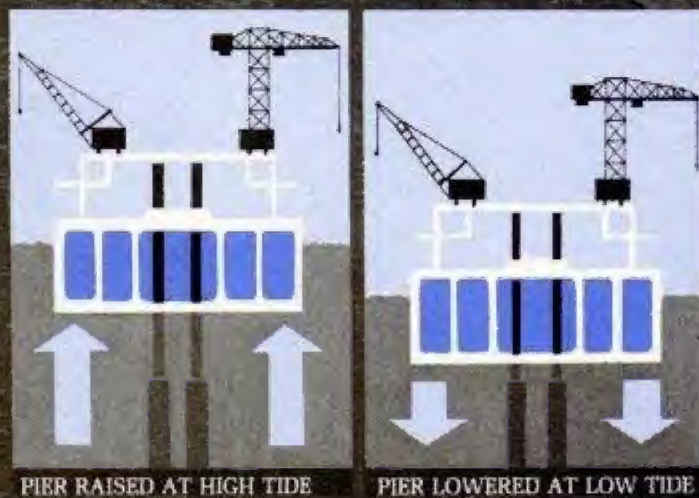
**T**he average active U.S. Navy ship is 15 years old. The average Navy port facility is 35. With the needs for continuous, extensive maintenance on sophisticated shipborne equipment—electronics systems, for instance—the Navy has been looking for something new in shoreside facilities. And the new technology would have to be modifiable itself.

One answer that recently surfaced at the Naval Civil Engineering Laboratory in Port Hueneme, Calif., calls for a floating pier. You may already have seen floating slips at small-boat basins, but the double-deck concept being developed by the Navy is on a vastly grander scale. The two-deck unit is built by hooking together a pair of steel-and-concrete modules each 600 ft. long by 75 ft. wide. The main, upper deck would stand 20 ft. above the waterline, allowing access for the key maintenance functions. Stairwells would lead to a lower deck with holding tanks, electrical substations and vehicle traffic lanes. The structure would ride up and down with the tides, eliminating the time-consuming chore of line-tending.

Replacing a fixed pier of similar size, the Navy estimates, currently takes about 18 months, but the floating pier could be assembled and tethered to its 58 pilings in as little as six months.



This huge floating Navy pier, which rises and falls with the tide, is guided by telescoping pilings. Its twin decks always remain level with ships, simplifying loading and servicing.



### Here come the new flying fish

**I**f you're enjoying the seas around Key West, Fla., and spot a couple of fast moving boats that don't seem to be touching the water, don't worry. It's not a mirage. You're looking at the Navy's new six-vessel Patrol Hydrofoil Missile ship (PHM) fleet. The pioneering squadron that operates out of Key West is made up of Jetfoils built by Boeing Marine Systems. The military vessels are similar to those already marketed to civilians by Boeing. But these flying fish have a few substantial differences: Each carries eight harpoon missiles and a 76-mm. rapid-fire cannon.

The PHMs resemble their civilian cousins in using Boeing's unique, fully submerged foils. These differ from traditional foils because the Boeing models are totally submerged, giving the vessel a smooth ride even in rough seas. Hydrofoils that just pierce the water rise and dip with the waves and often bounce passengers around the vessel.

The first Boeing Jetfoil "flew" in July 1974, and the first commercial operations began in Hong Kong the following year. Indonesia is already operating one of the military models off its coast.

Before delivery to the Navy, each of the Jetfoils undergoes tests conducted by the Navy Board of Inspection and Survey. In the tests performed at Boeing's Puget Sound facilities, the PHMs provided a smooth-operating platform at average speeds of 40 to 50 knots.

Vice Admiral John D. Johnson Jr., Commander of the U.S. Atlantic Fleet's Naval Surface Force, says that the PHMs may take part in Mediterranean exercises this year.

"The advantages of a PHM are that it has a terrific



Hydrofoils for peace or war: Boeing's passenger-carrying civilian ferry (right) teams up with Navy's new missile-firing PHM version (left), both high-speed, foil-borne vessels.



# TECHNOLOGY UPDATE



punch for a very small ship and it's a difficult ship to kill; it's a high-speed ship that can be deployed and repositioned very quickly," Johnson says.

Last year, Boeing gave a dramatic four-week demonstration of the Jetfoil in southeastern Alaska's Inside Passage, in the Juneau area.

The Jetfoils

emerged with flying colors:

They cut the time required by conventional ferries for a trip in half.

In the demonstrations, the Jetfoil *Aries* carried a total of 15,367 passengers

Large winglike bow foil, retracted above, swings up on pivoted strut for low-speed maneuvering, docking.

on 97 trips without a single breakdown.

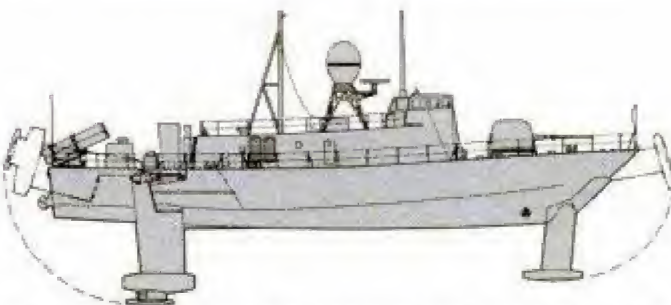
The *Aries* even won a special commendation for her captain, Bruce Bryant, and crew. The Coast Guard presented the award because the *Aries* came to the rescue of a ferry, the *Majestic Alaskan Explorer*, that had run aground with 77 passengers aboard. Dozens of passengers were carried safely back to shore by the *Aries*.

The PHMs themselves have also established some preservice records. The *Pegasus*, commissioned in 1977 as a test vessel, has already logged more than 100,000

nautical miles, a record for Jetfoils, during more than 5,000 hours underway. It also recorded the fastest transit ever of the Panama Canal: two hours, 41 minutes in June 1979.

## Ship above water

The foils of the new craft are attached to the hull by a system of struts that lift the ship several feet above



Drawing shows bow and stern foils both raised and lowered. the surface. The welded aluminum hull is not affected by water-resistance friction. It takes a crew of 21 men to keep a PHM on its military mission.

The five new hydrofoils that complete the current fleet were built for \$272 million. They're commissioned: *Taurus*, *Aquila*, *Aries*, *Gemini* and *Hercules*—all names of mythological gods and stellar constellations.

Editor: Dennis Eskow

Contributors: Robin Nelson, Sheldon M. Gallagher, Larry Wood, Rae Ludwig



## AVIATION

### Rocket bailout

**P**ilots flight-testing new, high-speed airliners have a problem. If something goes wrong, they have no safe way of bailing out. Fighter-type ejection seats are impractical in big, enclosed-cabin aircraft, and anyone attempting to open a door and jump would almost certainly be dashed back against a wing, engine or tail surface.

Faced with this challenge, a team of high-tech escape artists came up with a scheme that's daringly ingenious, if slightly bizarre. At the first sign of trouble, a pilot moves to the nearest exit door and hooks a lanyard to a ring in the top of his helmet. He then crouches down and pulls a handle.

What happens next may come as a shock, but could save his life. When the handle is pulled, the cabin door is blown off by explosive charges and a rocket, trailing the lanyard, is fired from a launcher tube inside the doorway. The rocket literally yanks the pilot out by his head, hurling him safely clear of the doomed aircraft. In less than five seconds, the lanyard automatically disconnects and the pilot's parachute opens. (At high altitudes, chute deployment is delayed until the crewman reaches a safe, preset pressure altitude.)

The novel ballistic escape system, dubbed AWAY (for Aircrew Walk-Around Yankee), was originally devised for emergency use on test prototypes of the A300 Airbus. More recently, it has been installed on the new Lear Fan, a sleek, turboprop corporate transport designed to provide near-jet speeds at half the cost of using jet fuel (see *Lear's Light Pusher*, page 101, June '81). The Lear Fan's unusual configuration (photo be-



Pilot of disabled airliner crouches in doorway just before pulling emergency ejection handle. Sequence at left shows how rocket plucks him safely clear of craft so chute won't foul.

low), with its huge Y-shaped tail assembly and rear-mounted pusher prop, poses special bailout hazards, making it an ideal candidate for the AWAY concept.

While the system has not yet had to be used under emergency conditions, it has been successfully tested on the ground with dummies ejected from a 300-mph, jet-propelled sled. Although the initial rocket pull is on the pilot's helmet, the actual force of the blast is transmitted by cables to his chute harness, so there's no strain on his head or neck. (The helmet anchor point was chosen as the least likely to permit accidental fouling of the lanyard during ejection.)

A typical AWAY installation consists of three rocket launchers in an upward-angled stack, each with its own coiled lanyard and firing handle. Thus, up to three crewmen can eject from a disabled craft in rapid succession. Developed by Stanley Aviation (now Stencel Aero Engineering Corp.), the system is simple, compact, easily installed and reasonably inexpensive.

But sorry, folks, it's only for test pilots. We ordinary passengers will just have to take our chances.



New high-speed, turboprop Lear Fan has unusual Y-tail, is undergoing flight tests.



## CORVETTE

(Continued from page 128)

subframe and at the lower control arms on each side. And the closer you look, the more there is to see. There's the aluminum propshaft, aluminum C-section channel which ties the tranny and rear differential, aluminum differential, integral differential cover and transverse beam, driveshafts, hub carrier, trailing links and lower tie rods. Low unsprung weight? No problem.

The rear suspension has been redesigned to incorporate four trailing links. The rear axle is located laterally by the integral differential cover and transverse beam. The beam is bolted to the body on either side of the car at the side rails. Bolted to this assembly are four more transverse links: two control toe-in and two control camber. Longitudinally, four forged-aluminum trailing arms locate the rear axle. The fiberglass rear spring hangs off the end of the tranny cover/beam and is located at the top of the hub carrier. To that is added a stabilizer bar.

The front suspension is fairly straightforward, except for the extensive use of aluminum and the fiberglass spring. It uses unequal-length upper and lower control arms, with the shock absorber mounted on the lower arm and located on top to a perch bolted to the subframe. The steering rack has a very fast 13 to 1 ratio. Yet, even with all this wizardry, and given the vehicle's high-speed capability, there's very little on-center feel at the steering wheel. At elevated speeds we found the car needs constant correction to keep it going in a straight line.

### The cockpit

The Corvette interior is as done up as you could want. The seats are terrific. They're well-bolstered, with adjustments for fore and aft and rake, naturally, plus air-bladder adjustment and side-bolster adjustment. It's all power assisted. There's a tiny air pump buried in the seat that will inflate three pockets in the lumbar support. Each pocket can be deflated individually to suit you.

The dash sports a really spacey digital gauge package in the best multihued video games tradition. The speedo and tach displays are right where you want them, while oil temp, pressure, engine temp and voltmeter are off to the right.

At Riverside Raceway, the Vette seems to live up to the advertised .95 g cornering ability and the neutral handling characteristics expected from its ideal 50/50 weight distribution. The car just flat sticks. It will inspire you to attempt driving feats beyond the limits of mortal man. But it does have limits.

You can induce trailing throttle oversteer, which, depending on how

you look at it, is good or bad. Leg it into a corner a little too hot, and decide that maybe you don't have the courage or the room to see it through, lift off the throttle and the sudden unloading of the rear will get you sideways. That's not necessarily bad, of course. You do want to be able to steer with the rear wheels on occasion. But it might be a big surprise to someone who might not like to steer with them. On a racetrack in a rear-drive, understeering car, modulating the throttle to get the nose pointed where you want to go is often the only way around. But the Corvette is so

neutral that at the point where past experience tells you a 3,000-pound car *should* be understeering, you've actually got a lot more to go. Since its limits are a lot higher than most drivers would be willing to experience, it will mean a re-education process.

The brotherhood of America's only true and pure production sports car can stop fretting. Palmer, McLellan and Chevy have produced a suitable pad from which to launch another decade of legends. And with Chevy's renewed, albeit closet-bound interest in racing, it should be an interesting decade. **PM**

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Compressor evacuates car's airconditioning system prior to adding new refrigerant (far left). At left, routine inflation of tires saves trip to gas station.

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hips and shouts, "I want them thrown back now!"

"But I still have to measure them and . . ."

"Well," he interrupts, jabbing a finger at the halibut on the deck, "then get to work!"

Beth returns to the pile at her knees, unshaken.

"That was the fish manager. I go through this all the time. The crew is understandably paranoid—they know the Coast Guard is just looking for a 'bust' for possession of illegal species."

Beth has been aboard the *18 Svezd Vlskm* for nearly three months, working amid tons of dead or dying fish in conditions that range from today's spring-like state to hurricane-force winds, towering seas and temperatures well below zero. She extended her original tour "because I love it," she says. Still, she admits, "It's grunt work."

## Factory at sea

Below decks, it's a different world, hardly suggestive of the bowels of a ship. The busy processing plant is a space-efficient factory of conveyor belts speeding American-caught cod and pollock to deheaders, fillet machines and flash-freezers.

In the center of the processing area is an even stranger sight; standing over a 10-foot table, dressed in white cotton smocks, white caps, white gloves and masks are a line of men surgically removing harmful parasites from the flesh of the fish.

At the end of the factory line, carried aft by conveyor belts, are the boxes of 18.5-pound bricks of frozen pollock fillets which will end up in the world's supermarkets or in fast-food chains as fish sticks.

Later that evening, the Soviet captain, Nikolai Ivanovich Trushin, invites the skippers of the American catcher boats—the *Great Pacific*, *Ocean Harvester* and *Royal Atlantic*—to his ship for dinner. It is the first time any of these Americans has been aboard the vessel that has been processing their hauls.

The weather has rapidly deteriorated and a solid wet snow flies across the *18 Svezd Vlskm* in horizontal sheets as the Russian lifeboat brings the men aboard. Nikolai, his black hair matted with ice, greets his guests a little shyly in Russian and leads them to his stateroom.

Nikolai presents a resplendent feast—borscht, lamb meatballs called pilmeni, Bulgarian white wine and naturally, vodka—for his American counterparts, Jonas, John and Olaf. These men, originally from the Norwegian island of Karmøy in the North Sea and

now living in Seattle, came to the United States because of the opportunities in commercial fishing.

Eventually the conversation, conducted by an English-Russian interpreter, gets down to what they each know best. The fishing has not been profitable, mostly undersized pollock that will fetch only a penny and a half a pound and good only as fishmeal. One of the Americans suggests that the fleet join the *Viking* and *American No. 1*, American trawlers which are currently combing the sea bed south of the Aleutians Chain several hundred miles away for cod. The three American captains discuss their proposal in an odd mixture of Norwegian and English.

It is agreed; the Americans want to head south. The request is translated to Nikolai and a cloud passes over his boyish face.

Nikolai proposes a toast. "Here's to friendship among fishermen of all nations and a hope that there are no misunderstandings among men of the sea."

The next day, the wind backs from out of the south, a sign that a storm system is moving up the Chain into the Bering. But despite the light snow and the short steep chop, the fishing has improved and the crews are jubilant.

Aboard the *18 Svezd Vlskm*, we overhear another Soviet processing vessel radio Jonas: "The captain sends his compliments on that haul. Pour yourself a toast . . ."

"No, no. I had my toast last night. It must have brought us luck."

Nikolai, standing near the radio, smiles privately to himself.

## Bad-luck Viking

A few days later I am on the *Viking*, the American trawler which has just returned empty-handed from the grounds south of the Chain. Spurred by reports that the other American boats may have hit the motherlode of spawning cod up here in the Bering, they have come to try their luck.

The *Viking* is a modern steel vessel equipped with tens of thousands of dollars worth of the latest and most sophisticated fish-locating equipment. Yet despite the gear, there is as much luck involved here as there is in sitting in a bass boat with a bamboo pole in a down-home fishing hole.

The *Viking's* skipper is Gary Bryant, a thoughtful, well-spoken man with a salty black beard and a quick smile. As part owner and captain of the 120-foot boat, Gary has pinned high hopes on the joint venture with the Soviets. And the *Viking* needs a few good hauls; its luck has been marginal at best with only a few productive days.

"The way I see it, this joint venture is a golden opportunity. The Soviets are providing us with a tool to explore our own fisheries. I'd like to see more Soviets and also Norwegians and the Danes up here helping us process our catches instead of giving all this fish away to the Japanese." He is referring to the heavy concentration of Japanese vessels with permits to fish for the "underutilized" bottom fish found within the 200-mile limit.

After a 2½-hour drag across the bottom, picking up whatever is in the way of the giant-mouthed net, Gary signals the crew to retrieve the haul.

"Doesn't look too bad," Gary says with forced indifference as the "bag" pops to the surface. It is apparent by the dark cloud of sea birds hovering over the net that it is a respectable catch. Old-timers in the business say you can tell the size of the catch by the number of birds over the bag.

After the transfer to the Soviet ship, we watch the hoisted bag spill its contents onto the deck. The processing ship has taken a distinct list on the side where most of the *Viking's* catch has been dumped.

"All right, eh? All right!" Gary blurts, handing me the binoculars.

His crew on the deck below are hooting and hollering. Gary blows the ship's whistle, a salute to his crew and to himself. The processing ship radios later that the haul was mostly pollock.

"Yeah, I see," Gary radios back. His disappointment that it was not more of the higher priced cod is evident, for cod fetches nine cents a pound. Pollock is worth only a cent and a half.

## Sabotaged by cod pots

Yet this haul was not as disappointing as one a few days earlier. Pulling in the net is always exciting business, a time when hope runs high. But there is hardly anything more frustrating than finding a yellow polypropylene rope wrapped around the warps—the hauling cables—before the net pops to the surface. It can mean only one thing. We had scooped off the sea bed two large wire mesh baskets—cod pots set by some fixed-gear fisherman. There had been no markers to indicate that anyone had set his gear in the area.

Ryk, one of the young crewmen aboard the *Viking*, angrily slashed the cod pots free with a razor-sharp fillet knife; most of the day's fishing would be forfeited while he and the others restrung the net.

Incidents of gear conflict between trawlers which drag the bottom and fixed-gear fishermen (crabbers, cod pot fishermen, lobstermen) have always

(Please turn to page 138)



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## STRANGE BEDFELLOWS

(Continued from page 134)

existed in fishing grounds all over the world. But because of the increasing number of American boats as a result of the 200-mile law, the gear conflicts involving foreign ships off the U.S. coasts have increased markedly.

In the Soviet port of Nakhodka, a fishing town far from the border of China and North Korea, Soviet captains blamed the Americans.

"The Americans are mostly at fault because they don't always mark their pots," says Ivan Petrovich Samsonov, who commanded a Russian fleet off the Oregon coast in 1979.

"The Coast Guard tells us it is very difficult to demand these fishermen tell where their gear is because there is no law that says they must."

### New role for the Coast Guard

Enforcement of the 200-mile limit law was mandated to the Coast Guard. The service, traditionally known for its heroic search and rescue missions in waters that extend far beyond the 200-mile limit, was also directed by the Congress to enforce tight fishing quotas now imposed on foreign fleets.

According to Coast Guard officials, the most extensive enforcement of the law is along the Alaska coastline, a coast longer than the U.S. Atlantic, Pacific and Gulf coasts combined.

I spent nearly a month during the most brutal part of the Arctic winter on the Bering Sea and the Gulf of Alaska aboard the Coast Guard cutter *Rush*, a sleek white-hulled ship armed with torpedoes and secret antisubmarine warfare equipment. She had been hurriedly dispatched from her home port of Alameda, Calif., to enforce President Carter's expulsion of the Soviet fleet from the Bering during the Afghan crisis. The fleet subsequently left without contest and has not returned.

On board the *Rush*, sipping a carefully measured ration of cheap brandy, I reflect that in this generation without heroes, these men, most of whom are still in their teens, risk their lives in a mission of routine danger in the world's wildest seas—far beyond the knowledge of anyone back home. And all to enforce the FCMA.

At one of the finer seafood restaurants in the old whaling port of Mystic, Conn., tilefish, a flaky white bottom fish, is priced at \$12 a serving. The portion on my plate is only one of several that will be served from the same fish. The fisherman probably was paid somewhere in the neighborhood of 30 cents for the whole fish. But then again, that's 30 cents more than the fisherman ever realized before from the depths of the ocean.

PM



ing style. They offer factory-tapped holes to accept stabilizers, bowsights, bow quivers and adjustable arrow rests. Lightweight, skeletonized metal or hard-plastic eccentric wheels produce the most efficient energy release during a shot.

Fortunately, such two-wheel compound bows are less expensive than most four-wheel and six-wheel bows—primarily because they have fewer parts and require less manufacturing and assembly cost. Almost all of this country's top tournament archers currently use two-wheel compound bows by various domestic manufacturers. The majority of hunting archers have followed suit with similar bows, appropriately camouflaged at the factory or at home. In addition, several large archery companies like Jennings, in Valencia, Calif., now offer two-wheel compound assembly kits with do-it-yourselfers in mind.

Primary goal of most modern bow manufacturers is producing ever higher arrow velocities. Serious target archers demand top arrow speed to minimize wind drift and maximize flat trajectory, and most modern bowhunters prefer flat-flying arrows, as well, to allow solid hits at unknown ranges.

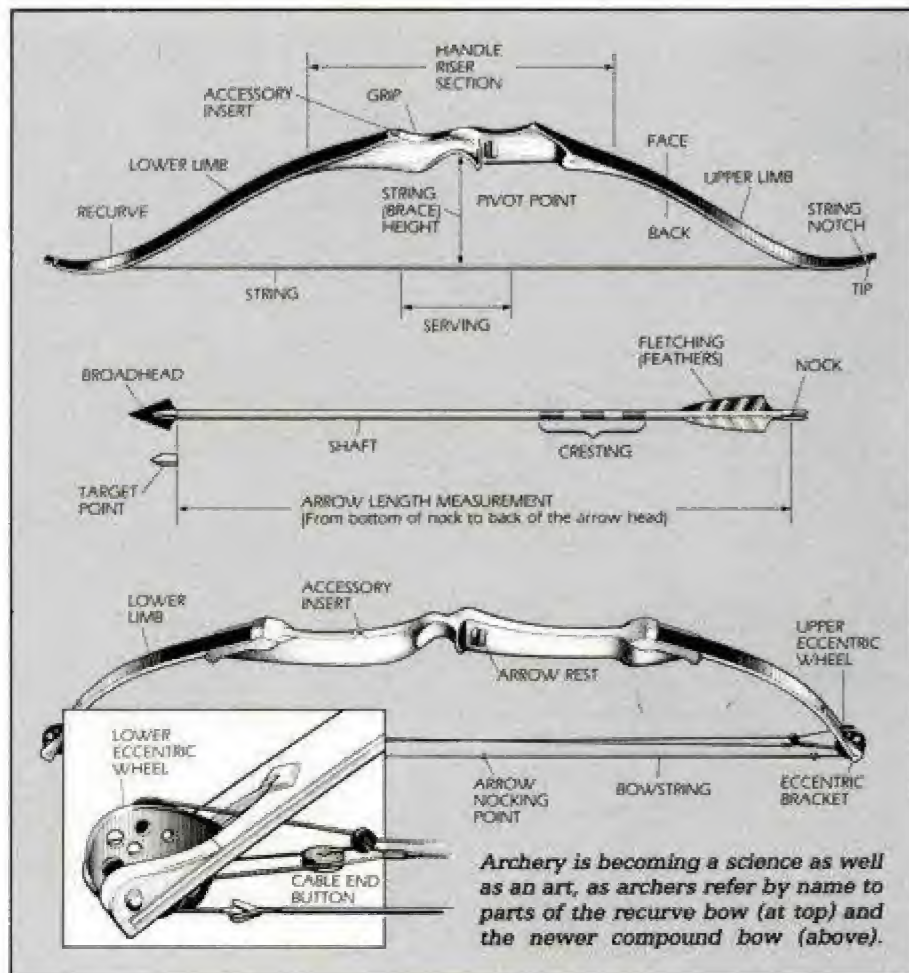
A compound bow can be made faster

in two basic ways. First, limb and/or wheel design can be refined to store more energy and minimize energy loss during a shot. Second, arrow weight can be reduced to step up projectile velocity. Bow manufacturers have been experimenting with lighter, snappier limbs made with graphite and maple laminations, but many of these have proven far too fragile and expensive for practical use. And at this time, conventional round, compound wheels with needle bearings or solid bearings of turcite, brass, or similar low-friction material may be as fast as they are likely to get. As a result, compound manufacturers have recently turned to new eccentric-wheel shapes and so-called "overdraw" handle designs to increase arrow velocity markedly.

The average two-wheel compound bow, matched with an appropriate aluminum arrow, shoots that arrow about 200 feet per second (f.p.s.). By contrast, an average modern recurve bow of comparable draw weight shoots the same arrow at about 180 f.p.s. and a laminated-limb longbow shoots the same arrow at about 160 f.p.s.

Bow manufacturers have successfully increased average arrow speeds during the last two years by replacing con-

*(Please turn to page 140)*



Archery is becoming a science as well as an art, as archers refer by name to parts of the recurve bow (at top) and the newer compound bow (above).

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## HIGH TECH FOR ROBIN HOOD

(Continued from page 139)

ventional round wheels with egg-shaped cams that drop off in draw weight more abruptly near full draw and, therefore, store more bow-limb energy. The new generation of cam-bows, which include Bear's Delta-V and several models by York and Precision Shooting Equipment, cast arrows an average of 10 to 15 percent faster than comparable round-wheel compound bows, using the same handle risers and limbs. Cam-bows tend to be noisier to shoot than round-wheel bows, and at this point seem less accurate. However, they currently produce the ultimate in snappy shooting performance.

Another bow modification which promises to be popular with hunters is the overdraw bow, which features a grip well forward of the arrow rest. Martin Archery has been a pioneer in this particular design endeavor.

An overdraw bow allows the archer to shoot a shortened arrow which, in turn, produces superior arrow velocity. Not only is a truncated arrow much lighter in weight than a full-length arrow, it is also much stiffer. This lets an archer use a smaller, thinner-wall, overdraw arrow than normally recommended for his draw weight on conventional shaft-selection charts. The shorter, lighter weight arrows shot from an overdraw bow produce an ultraflat tra-



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jectory. Overdraw bows tend to be less accurate than bows with conventional handle risers because arrow-rest torque during a shot is accentuated by the frontal orientation of the grip. For this reason, the overdraw isn't popular with serious target archers.

Recurve bows and longbows, with modern fiberglass-and-wood laminated limbs, are faster and smoother to shoot than anything made before 1960, yet such bows are enjoying only limited popularity. Today, the compound bow is clearly the odds-on favorite.

One product of interest to archers is the compound crossbow, recently designed by Precision Shooting Equipment of Tucson, Ariz. This adaptation of the conventional crossbow shoots bolts with sizzling speed, an advantage for the hunter. Crossbow hunting has recently become legal in several states.

## Arrows

As with bows, advances in modern arrow design have been made with speed and trajectory in mind.

The XX75 and X7 aluminum-alloy arrow shafts introduced some 20 years ago have almost completely supplanted older style cedar and fiberglass shafts, primarily because aluminum can be drawn in tubular form, tempered and straightened with a rigid uniformity

unheard of in other less consistent shaft materials. Tubular aluminum arrow shafts also tend to recover more quickly when they leave a bow, bending slightly from side to side after the initial thrust of the bowstring, but not with the prolonged, exaggerated sluggishness of a heavier, whippier shaft of wood or fiberglass. The quick-recovery characteristic of aluminum arrows has proven especially desirable with compound bows, which tend to slam an arrow harder in the back end and thus increase initial arrow flexing. Over 30 sizes of aluminum arrow shafts are available to hunters and target buffs.

Additional major improvements made in recent years include durable, waterproof plastic fletching; nocks which snap to the bowstring for convenience and safety; threaded female arrowhead adapters in the ends of arrows instead of the older style, glue-on arrowhead tapers; plus durable, oxidation-free, hard-anodize finishes on all aluminum shafts.

But shaft manufacturers are constantly working toward improvements. At present, the most promising and innovative shaft experiment is the aluminum/graphite combination. This design is currently being tested by Easton Aluminum of Van Nuys, Calif., the world's largest arrow-shaft maker.

The aluminum/graphite shaft consists of a thin tube of high-tensile aluminum alloy coated with lightweight carbon graphite. Such a shaft has the stiffness required for accuracy, while weighing less than a conventional aluminum shaft of the same rigidity. The result is flatter arrow trajectory coupled with quicker bend-recovery—both of which give better target scores for discriminating archers. Because aluminum/graphite arrow shafts are relatively fragile and costlier than the best aluminum target shafts, they are likely to remain a low-production, special-order luxury of tournament competitors.

## Shooting accessories

The wide variety of extras available at archery stores supposedly enhance hunting and target accuracy. Some work as advertised, and some don't.

Bowsights have been around for many years, but modern sights are better than ever. The best hunting models are solid, all-metal designs with four or five sight pins to be set for various shooting distances. Compact electronic sight pins that allow pinpoint aiming in low-light conditions are popular. Target-shooting sights generally mount well out in front of a bow's handle riser to ensure sight definition, and usually

*(Please turn to page 142)*

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## HIGH TECH FOR ROBIN HOOD

(Continued from page 141)

feature micrometer-click adjustments for windage plus instant vertical adjustment to match any range. A majority of serious tournament shooters use 2-power or 3-power scopes on their sight bars instead of conventional sight pins—a practice which ensures exact aiming at distant bull's-eyes.

Bow stabilizers, spring-loaded arrow rests, bowstring peeps and similar gadgets are proven bow-shooting aids. The mechanical bowstring release is relatively new, and improves shooting accuracy dramatically. Favorite designs today are smooth and dependable. A bowstring release grips the string just below the arrow nock and allows the archer to shoot by pulling a trigger or pressing a button. Free-style archers find this gives shooting consistency that's impossible to get with conventional, three-finger release. The most common, the so-called "rope release," holds the bowstring with a torque-free loop of nylon cord and lets go with little or no noise. A mechanical release is slow to use, but many bowhunters are using various models for long-distance shooting.

The optical rangefinder is perhaps the most important aid to appear dur-

ing the last 10 years. A primary bugaboo has always been the arrow's dramatically arching trajectory which requires shooters to know range within a yard or two. Today, the worry of shooting at unmarked distances is largely past. Ultra-accurate, triangulation-type archery rangefinders are available at reasonable cost. The Model LR-80 from Ranging Inc., East Rochester, N.Y., is a typically good design, allowing an archer to estimate distance within half a yard at 80 yards.

### Bowfishing equipment

A dramatic recent change has also been the improvement in modern bowfishing equipment, due in part to the popularity of tournaments similar to bass fishing contests. Bowfishermen vying for prizes have scrapped old-style, drum-type bow reels, sluggish nylon line, inconsistent solid-fiberglass fish arrows and crude, one-piece fish points with heavy-wire barbs.

The serious tournament archer bent on taking record numbers of carp, gar, or similar rough fish generally uses a two-wheel compound bow, and a large-capacity, pushbutton bowfishing reel mounted on the front of the bow, holding small-diameter, perfectly round Dacron cod-fishing line in the 70-pound range. This attaches to an ultra-accu-

rate, heavy-wall XX75 aluminum bowfishing arrow with a special screw-in nock which holds the line, and a sharp, streamlined fish point with spring-loaded barbs that retract for instant release of a fish once it's been landed. Such a setup is accurate to 20 yards.

### Miscellaneous gear

Just about every phase of hunting and target archery has improved during the early 1980s. Camouflaged, dull-anodized finishes are available on aluminum items like tree stands and hunting arrows. Quiet, durable wool clothes in camouflage patterns can be treated with a great variety of odor-masking scents like acorn, skunk, apple, sweet corn, doe-in-heat, earth, pine and others. For target shooting, portable target butts are made of lightweight materials like self-healing ethafoam.

As archery becomes increasingly popular and equipment continues to improve, some revolutionary new bow design could change the complexion of the sport. But now, manufacturers continue to perfect the excellent compounds with faster limbs, more efficient cams, overdraw handle risers and the like. Coupled with these are the lighter, faster arrows and improved bow-shooting aids. Archers never had it so good. **FM**

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## COUNTRY WEATHER VANES

(Continued from page 100)

Surform tool. Following the drawing and the color photo, use rasps and a whittling knife to shape the stag body (edges) realistically. A handheld grinder such as a Dremel or Foreman tool is very helpful. Sand the work smooth with medium-grit (80) sandpaper; however, don't sand away the detail.

Distress the stag in the following way to ensure an antique appearance. Tap at random with the ball end of a ball-peen hammer. Test on scrap wood to determine the amount of force required to make a smooth dent. The marks should be distinct. Use care on the tail and legs to avoid breaking them. Use an icepick or awl to add some "bullet holes" like those found on many antique vanes.

### Shaping the antlers

It's easiest to shape the antlers with a hand grinder, but you can use a whittling knife if you prefer. Alternate the direction of the antler tips to achieve a three-dimensional effect (when viewed from the front). Shape the bottom of the antlers into a flat, angled pad. Counter-bore for a No. 6 flathead screw. Cut a 1/16-in. mortise into the head at the antlers' attachment point.

Bore pilot holes in the head for the attachment screws. Set the antlers aside.

### Cutting the base

To make the base, first cut the two wood pieces that form the roof. Nail them together with 4d common nails. The ball resting atop a rectangular base is carved from a single piece of 4x4. You can substitute a ready-made gate post finial, if preferred.

Before you shape the ball, bore the hole for the metal rod that holds the stag. Then mark off the ball area. You may want to round off the edges and corners with a sabre saw before shaping the ball with a whittling knife or carving tools. Or, you can turn the ball and rectangle from a single block of 4x4 stock. Shape the ball on the lathe, remove stock from lathe and shape the rectangular base, using saw and hand tools. Then cut a 90° V-shape into the bottom of the rectangle to fit it over the roof.

Cut a 3/8-in.-dia. x 8 3/4-in. metal rod. Position the rod vertically under the stag so it touches the stag's front hoof. Bore a hole for the rod in the stag.

Cut a 3/4-in.-dia. x 20-in. dowel with tapered ends according to the drawing. Bore a 3/8-in.-dia. hole in the dowel for the metal rod. Install the dowel on the rod. Secure the dowel to the metal rod with epoxy adhesive; secure the dowel

(Please turn to page 144)

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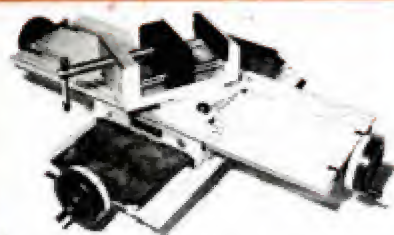
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## COUNTRY WEATHER VANES

(Continued from page 143)

to the stag's hind hoof with white glue.

### Painting the stag

The weather vane was finished using Rust-Oleum paints; the catalog numbers for the paints that Adam used are in parentheses next to the colors. Apply the paint with a brush except as noted. First, paint only the roof with flat black paint (No. 7776). Apply two coats of paint.

The metal rod, wood dowel, ears and antlers are painted with the same color mixture: a black-green-bronze mix of flat black, sunset yellow (No. 7745) and hunter green (No. 7738). Daub the paint over the entire surface with a "sponge" of Turkish towel wadded into a ball.

Immediately after you apply the paint, add a little more yellow and green to lighten the mix. Blend this lighter color on about 80 percent of the antlers, dowel and rod for variation. The tips should be lighter than the rest of the antler. When they are partially dry, rub with steel wool through the paint on the ridges and tips back to the wood to create a bone effect.

To finish the stag and the ball, spray three coats of copper metallic paint (No. 7714), or enough to make a shiny surface. Let the paint dry thoroughly after the third coat.

Apply artificial beads of "solder" at the neck, tail base and points where the legs join the body, using a tube of plastic aluminum repair material such as Devcon AL-40. This gives the appearance of metal seams. Let this dry for approximately 10 minutes.

Mix some water putty (such as Durham's) to a thick consistency. Apply it to the stag and ball, completely covering the metallic color, but not filling in the details. Set the pieces aside for several hours until thoroughly dry.

Attach the ball to the roof and install the stag on the finial.

Mix a flat, dull yellow-green mixture using a flat white (No. 7790) as the base with smaller amounts of hunter green, sunset yellow, and touches of black and royal blue (No. 7727). Look at the color photo of the stag and a piece of weathered copper if available to get an idea of the shade. Brush the greenish mixture over the stag and the finial.

While the paint is still wet, dip the same brush or rag into a bit of flat black paint and lightly into a thinner such as turpentine. Touch the stag along the top edge across the body, tail, top edge of the legs and head, allowing the thinned paint mix to run down through the wet green mixture. Don't try to

touch up the runs. If too much black appears for your taste, quickly apply a little clear thinner at the top edge.

The dull black discoloration often appears on the under edges, under the jaw line, crotch, knee bend and at the lower edges of the solder seams. The results should leave some of the green mixture with light black "rain" marks and some whitish water putty showing through. The thinner should drip down on the roof, as well.

Let the stag dry for several minutes. Then hold a toothbrush dipped in black at a 60° angle to the stag, push the bristles back with your finger and let them spatter the stag. Do this only once on each side. Let the paint dry thoroughly.

Finally, if desired, use triple-O steel wool to reveal tiny amounts of copper on the hoof edges, tail tip and ridge of the nose. Also use steel wool to reveal the solder seams.

Secure the antlers with screws. Then fold the metal ears and attach them with an upholstery tack.

## 2 Locomotive

You can make the locomotive of metal roof flashing. It's commonly available at lumberyards and home centers.

Draw a grid of 2-in. squares on paper. Following the pattern on page 101, pencil in the locomotive outline. When you are satisfied, cut out the pattern. Tape it on the flashing and scribe around it with a nail. Note that the smoke is a separate piece of metal attached by machine screws.

Cut out the metal. First, clear metal away from the corners and other tight places with a drill. Then use a sharpened steel chisel, a scroll saw or a jeweler's saw to cut the lines.

File away the burrs, leaving some of the roughness for a hand-crafted appearance. Flatten the metal by laying it on a concrete surface and pounding the edges with a mallet or hammer. Go over the surface lightly, tapping to create slight dents to further the antique appearance.

Cut the bar stock to length and position it on the lower edge of the locomotive. Mark and drill through both pieces of metal for the machine screws. Installing one machine screw before making the remaining holes will avoid offset holes.

Make the stop for the vertical rod from a 11-in. angle brace. Cut off 1/2 in. from one side. This should remove any holes on that side. Use a file to round off the corners. Drill and attach the angle brace.

Cut two sheet-metal straps to hold



the rod in place. Rest the rod on the work surface and shape the straps over the rod with a hammer or mallet. Use a chisel to form a clean angle at the point where the strap meets the locomotive surface.

Position the rod against the angle brace. Use a square along the edge of the bar stock to make sure that the rod is perpendicular. Position the straps and bore or punch holes with a nail for the machine screws. Drill holes and secure the smoke in place with machine screws.

### Constructing the base

To give weight to the base, Adam Peck made it of a scrap piece of butcher block. But any piece of dense hardwood will do the job. If you use lighter pine, enlarge the base to support the vane.

Cut the base to size and round all edges lightly with a rasp. You can distress the base by striking the visible sides flat against a rough concrete surface.

Use a drill press or drill guide with your portable drill to bore a plumb hole centered on the block for the rod. Test-position the vane and rod to assure stability before proceeding.

Cut enough railroad ties to cover the length of the base. Place them 1½ in. on center. Cut rails and round their top edges with sandpaper. Lay the rails inside the nailheads on the ties.

### Finishing the locomotive

Brush two complete coats of metal primer (Rust-Oleum's No. 769 or other) over the train, rod and base. Apply the second coat as soon as the first is set enough not to lift. Lightly brush away runs or drips on the surface. Leave drips and beads of paint along the edges. Leave any puddles on to alligator. However, do not leave runs on the surface.

When the primer is set enough so it won't lift (about one hour), apply two heavy coats of flat black paint (No. 7776) in the same way you applied the primer. Let the paint dry thoroughly—about 48 hours.

To achieve a weathered look, apply the following techniques sparingly:

- Use a wooden spoon or wooden stick to knock off beads of paint. Strike the edges and machine screws to reveal some prime coat.
- When dry, wash the piece with detergent. Test a spot using a strong cleaner and a scrub brush.
- Dust wood ashes on and wipe them off to achieve a "patina."
- Bend the points of the arrowhead and straighten them so a crease is visible.

## 3 Sloop America

The sloop *America* is composed of a ¾-in.-pine hull, dowel masts and booms, and sails made of roof flashing or other sheet metal.

Begin work by drawing a grid of 2-in. squares directly onto the pine stock and sketching in the hull (see drawing, page 100). Cut out the hull and the two cabins. Then carve the bow and stern shapes with a hand grinder or a whittling knife. Sand the parts smooth with 80-grit abrasive.

Use a drill press to bore the mast and shaft holes according to the drawing.

Note that the holes line up. However, do not bore through the wood; make separate holes.

Drive 4d finishing nails into the hull as shown in the drawing. Bend the nails over so you can attach sail wires to them later.

### Making the masts

Cut the main mast dowel. Shape the ball on top. The gaff fits into an angled hole in the main mast. To bore the hole, insert the dowel in a V-block holder made of scrap wood. Bore the hole on a drill press. Glue the mast in place with white glue.

Cut the top mast. Taper it to shape at the top and cut away the surface next to the main mast for a flush fit. Carefully cut a ¼-in. notch in the top mast to fit the topsail.

Glue the top mast in place. Wrap the masts together with 26-ga. or other light wire and tuck in the loose ends neatly. Embed the end of the wire in glue; wipe off excess glue.

Cut the main boom. Attach it to the main mast with wire as shown in the drawing.

Cut the gaff and taper the free end. Reduce to ¼-in. dia. the end that is inserted into the main mast.

Cut the bowsprit, taper its free end and shape the other end according to the drawing. Bore a ¼-in.-dia. pilot hole, then glue and nail the bowsprit in place with a 4d finishing nail.

### Shaping the sails

On paper, carefully draw a grid of 2-in. squares to use in enlarging the four sails and the *America* banner patterns. Sketch in the sails and banner, then cut out the patterns. The flag and mainsail are one piece.

Tape the patterns to sheet metal, scribe around them with a sharp nail and cut out the sails and the banner. Use a sharpened steel chisel, a scroll saw or a jeweler's saw.

File away the burrs. Flatten the metal

(Please turn to page 146)

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## WEATHER VANES YOU CAN MAKE

(Continued from page 145)

if needed by laying it on a concrete surface and pounding the edges with a mallet or hammer.

Create ripples in the flag by tapping with a mallet or hammer over a 6d finishing nail. You might try this on scrap metal first to get the feel and master the technique. Shape the furl in the banner by bending the metal with needle-nose pliers.

### Fastening the sails

Begin securing the sails to the masts and booms. First bore holes in the mainsail for the reefing wire and wire to attach the sail to the gaff, main boom and main mast. Use a sharp nail to make the holes.

Attach the mainsail to the main mast with wire loops. Cut oversize wire lengths, feed them through the sail, twist them snugly to the mast to secure the sail, then cut the wire close to the loop. Attach the mainsail to the main boom in the same manner. Leave it free of the gaff.

Bore attachment holes in the topsail. For the moment, attach the topsail to the top mast with a single loop of wire at the top. Attach the gaff to the top and main sails with one wire running through both sails and around the gaff. Attach the remaining wires to the top mast.

Attach the mainsail wire from the main boom to a 4d finishing nail bent over behind the aft cabin.

Bore attachment holes in the jib. Using the jib to locate the spot, bore a hole through the top mast for a wire to secure the jib. Fit the wire through the top of the jib and secure it temporarily with a small twist.

Thread the loose end through the mast and leave it unsecured for now. Wire the lower rear foot of the jib to a bent 4d finishing nail at the bottom of the mast. Bore under the bowsprit to attach wire to the forward foot of the jib. Secure the wire. Bore three attachment holes in the foresail and secure it in place with wires.

Attach the banner by wrapping it around the top mast and tapping it with a mallet to form a collar. Wrap the banner so the tabs fold across the back side.

The banner should swing freely on the mast; it is removed for painting. Feed reefing wires through the mainsail and flatten them against the sail.

### Constructing the base

The sloop base is a lighthouse which rests on a stand with an octagonal cap. Lay out and cut the front and back of the stand, make the V-grooves and ease the top corners. Cut the stand sides. Glue and nail parts together with 4d

common nails. Lay out and cut the lighthouse from a 4x4. Use a drill press to bore a 3/4-in.-dia. hole for the shaft.

Nail the cap to the bottom of the lighthouse. Place this assembly on the stand and nail through the cap.

Cut the pieces for the "N," which designates North. Glue the parts together. After the glue has set, glue the N to the lighthouse and temporarily tape it in place. Cut the connecting dowel.

### Finishing the sloop

Apply the following Rust-Oleum paints (catalog numbers in parentheses) or oil-base paints with a brush. First, brush two coats of flat white (No. 7790) over the entire weather vane, including the base. The paint should fill the space around the wires and nails; however, don't let it run. Let the paint dry overnight.

Next, remove the banner and paint it. Paint the ground first and let it dry. The ground is regal red (No. 7765), the lettering and stars are sunset yellow (No. 7745) and there are touches of black (No. 7779).

Begin from the top and paint the sloop: First paint the flag with regal red and royal blue (No. 7727). Then paint the sails a sand color (No. 7771). The hull is gloss black, the cabin sides are hunter green (No. 7738) and the cabin tops are gloss black. Let the hull dry before painting the waterline regal red. Add other touches of color, following the color photo.

## 4 Indian and bear

The Indian and bear weather vane is made of 3/4-in. pine stock. Its features are carved in low relief.

Begin work by drawing a full-size grid of 2-in. squares on cardboard. Draw in the Indian and bear with the ground underneath them, the arrowhead and the feather (see plan, page 101). Cut out the patterns and trace them onto wood.

Cut out the designs with a scroll or band saw. Or rough-cut the figures with a sabre saw and finish with a coping saw.

Use a whittling knife, carving tools or a hand grinder to shape the headdress and to cut low reliefs into the surface to outline the details. It is easier to handle the pieces if you separate the bear and the Indian.

In shaping the headdress, start with the front feather, after the plume at the top of the bow. Round it off in an arc to the right. Then carve out a slight concave shape to create the appearance of the feather bending. Carve as much or as little as suits you. Repeat down the



headdress, shaping the tips in alternating directions.

The rest of the carving on the piece is low relief. For example, the headband rests over both the headdress feathers and the head. Therefore, carve the feathers and the head slightly down to meet the headband; shear-cut the headband to meet the feathers and the head. The same applies to the neck band, arm and leg.

Carve the plumes at the legs and on the bow to a point. Cut in at the base to form the plume shape.

Carve the arrowhead to a point. Round and smooth with 80-grit abrasive all of the uncarved outer edges on the piece. Simply round and smooth the bear.

Mark and bore holes for the eyes of both the bear and the Indian. Mount the two in U-channel stock. Drill and set machine screws. Installing one machine screw before proceeding will avoid offset holes.

#### Carving the arrow

Carve the large arrowhead to a sharp edge all around. Cut concave shapes into the surface. The "cutting" edge of the arrowhead should follow the midline of the material.

Whittle the tail of the arrowhead down to 1/8-in. width to fit between two pieces of half-round molding that form the arrow shaft. Whittle a fin along the top edge of the tail feather to 1/4 x 1/2 in. deep. It will fit between the two pieces of half-round. Then cut the molding to size.

Shape the lower part of the tail feather to a thin edge. Glue the flat surfaces of the half-rounds with white glue; clamp together lightly in the center. Quickly slip the arrowhead and tail feather in place. If necessary, carefully tack-nail the parts.

Coat a shoelace with glue and wrap it tightly around the shaft at the base of the arrowhead. Wrapping should be slightly irregular. The last wrapping should crisscross on one side. Use a pocket knife or other tool to slip the loose end of the lace under one of the wrappings. Wipe off any excess glue. An additional clamp behind the shoelace may be required to close the shaft. Set the arrow aside to dry.

Bore two holes through the channel into wood for 1/8-in.-dia. threaded rods which attach the arrow. Lay the arrow in place next to the channel and mark for the two 1/8-in.-dia. rod holes. Drilling will be through the glue joint, so be sure the glue is dry and the arrow is stable.

Thread the 1/8-in. rods up through the arrow shaft into the base of the vane. Fit plain or capnuts on the rod ends.

Once they're in place, lightly file the threads smooth.

#### Finishing the piece

Use three colors of Rust-Oleum or oil paints on the weather vane: flat black (No. 7776), flat white (7790) and terra cotta (7759). Numbers are Rust-Oleum catalog numbers.

Brush terra cotta onto the face, arms and upper legs of the Indian and on the ground and arrow shaft. Apply white to the headdress feather, tunic body, leggings, plumes and arrowhead wrap-

pings. Tips of the headdress feathers, headband, tunic trim, bow, bowstring, legging trim, arrowhead and bear base are black. Follow the photo to paint other details.

The paint should fully cover the area you are working on so that no wood grain or knots show. Apply several coats of each paint. Wait an hour between each coat until the paint sets. Let the entire piece dry for 48 hours after the last coat is applied. Carefully tone down the white if desired by wiping with fireplace ashes. **FM**

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## MAKE YOUR OWN WEATHER FORECASTS (Continued from page 97)

entific, Barrington, N.J. 08007). I beat three local forecasters with next-day predictions in my neighborhood four times over a three-week period. (The pros differed in their forecasts only once, a strong indication that their approach is scientific.)

Of course, I couldn't predict the weather for midtown Manhattan, the forecasters' home base, which is 15 miles away. But the professionals could. And they were accurate to within 5° F. on 20 out of 21 days—far better than my record for my local weather.

Try forecasting the weather using the most basic equipment or PM's chart on page 97 and you'll soon learn the pleasures of being right, while developing a profound respect for the beleaguered TV forecaster.

Just by using your senses, you can

make surprisingly accurate predictions. At the next full moon, you may be able to impress your friends by calling the next day's weather based on the presence or lack of one or more halos. No halo and clear skies probably foretell a clear day ahead. A large halo in clear skies indicates a warm front is moving in and rain is on the way. The halo is formed by cirrus clouds, those high webby visages that ride the top of a warm front. In warm weather, a double halo, or two decks of clouds, indicates that a long-lasting rain is due. The double halo is a bit less accurate sign in cold weather. (You can spot halos on half-moons and even quarter-moons after you get some experience.)

While halo-watching is useful, there are more sophisticated ways to use the clouds as indicators. By knowing the

## Building Heathkit's Digital Weather Computer

To build Heathkit's ID-4001 Digital Weather Computer (\$399.95) you won't need much knowledge of electronics or meteorology, though the kit makes it easy to learn a little about each. When you uncrate the parts, you'll find everything laid out in good order, beginning with a very clear, easy-to-check parts inventory. The manual even opens

vides readings for barometric pressure, wind speed and direction, indoor and outdoor temperature, time and date. All read-outs—which appear on an attractive and fun-to-use board—are digital, using light-emitting diodes (LEDs). The unit operates on household current (110 or 220 v.a.c.), but can also run on battery power in a blackout

*Microprocessor-based sensors in foreground record the temperature and barometric readings in Heathkit weather station. Behind the sensors are the LED board, with the displays, the CPU board with the station's memory, and control panel board. Power supply board is not shown.*



with a course on how to use solder, which may come in handy.

In the 28 hours or so it took me to inventory the parts and assemble and calibrate the set, I found only one flaw. In the assembly instructions for the central processing unit (CPU) board—the computer's memory—there's a diode called for in the middle of the board. But, on that same spot on the board itself, I found stamped information calling for a capacitor. Double-checking the schematic, I found it was, in fact, a capacitor and not a diode that was required. (Don't let words like capacitor and diode throw you; the plans have pictures and step-by-step instructions.) PM's Heathkit was an early set. Current models have an updated set of instructions that have cleared up the confusion.

The rest was smooth sailing. The set pro-

or on a boat. The electronics are laid out on four boards: LED; CPU, including the microprocessor chip; power supply; and control panel.

All components are spaced wide enough apart to prevent short circuits from accidental solder connections.

The Heathkit is designed to interface with any general-purpose computer, allowing you to chart long-range patterns and set up experiments. The weather sensors came online almost immediately after startup, and gave faithful readings.

To build the weather station, you'll need a 25 to 40 w. soldering iron, wire strippers, pliers, long-nosed pliers, diagonal cutters, 1/8" and 1/4" screwdrivers and a Phillips head screwdriver. The kit also suggests you have a desoldering bulb handy, but if you're careful, you won't need one.—*Ange! Vargas*







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## AUTOMAKERS WHO DARED

(Continued from page 81)

parent companies, but others didn't. Let's take a look at a few of the more noteworthy.

Ford Motor Co. lost an estimated \$250 million on the ill-fated Edsel. And that was in 1958-60 dollars. In today's money, the Edsel would translate into a bust of almost \$1 billion!

Yet the Edsel wasn't a bad car, really—just poorly timed and, with its horse-collar grille, an easy butt for TV gag writers. But if you look around the auto industry's voluminous attic, you'll find a lot more "Edsels" that weren't nearly so well publicized, but that lost money on every bit as grand a scale.

For example, right around the time of the Edsel, Ford launched another, more illustrious automobile, the 1956-57 Lincoln Continental Mark II. No one thinks of the Mark II as an "Edsel" or a money loser, and Ford released no profit-and-loss figures on it. Yet if you think about the car and its production totals, you have to conclude that the Mark II, car for car, had to be an even greater drain on Ford than the Edsel. Of the 3,012 Mark IIs built in their 22 months of production, each one amounted to \$1,000 down the drain.

### Mark II was special

To give it its due, though, the Continental Mark II was a cleanly styled, innovative, luxurious car that shared only its engine and running gear with the mass-market Lincoln. Its sheet metal, square-tube frame, suspension, interior and many accessories were unique. These vehicles were meticulously assembled, each bolt torqued by human muscle, not by machine; each car painted with four coats of hand-rubbed lacquer; each interior upholstered in matched hides; all plating exceeding industry standards by a factor of three; each engine and transmission individually bench tested, then road tested, then disassembled, inspected, reassembled and road tested again.

Fully equipped—with air conditioning being about the only extra-cost accessory available—the Mark II sold in 1956 for \$9,517. Air cost \$720 additional. William Jeanes, writing in *Car & Driver*, said that, "... to show a profit, the material and manufacturing that went into the Mark II would have required a price nearer to \$100,000 than \$10,000."

Not that Ford suffered money losers alone in that era. Cadillac had a lulu, too, and again it's a car we never think of in Edselian or De Lorean terms. The automobile I have in mind is the 1957-58 Eldorado Brougham, a model best remembered for its stainless-steel roof. It also happens to be the vehicle that

introduced quad headlights to U.S. production cars.

### Brougham answer to Mark II

The Cadillac Eldorado Brougham came in answer to Lincoln's Mark II Continental. It carried a price tag of \$13,074 and, in all, only 704 1957-58 Broughams saw the light of day (another 200 of a totally different body style were crafted in Italy for 1959-60 seasons). By conservative estimates, Cadillac lost \$10,000 on every Brougham it sold during 1957-58.

Again, I'm not deprecating the quality of the car itself. It was magnificent by any yardstick—luxurious to the point of excess in an era of unparalleled automotive excesses.

I couldn't begin to enumerate all the Eldo's factory equipment, but to give you just a sampling: automatic temperature control with air conditioning and individual dual underseat front and rear heaters; a matched set of six little magnetized silver tumblers; hollow rear armrests containing Arpège perfume and a custom atomizer, note pad, silver pencil and mirror; pillarless, four-door hardtop construction; air suspension (one of the car's weaker points); six-way memory seat; power everything else including ventipanes and door locks; electric decklid raiser and lowerer; automatic engine restarting; twin four-barrel or triple two-barrel carburetion; forged, vaned, aluminum-hub wheels; polarized sun visors that darkened when tilted; grey-smoked tinted glass; and an awful lot more.

Of course GM and Ford lost money on these two modern classics, but the cars weren't really intended to make great gobs—just break even if they could. I don't believe the manufacturers expected to lose quite so much as they did, but the Mark II and the Brougham were principals in a game of prestige-car one-upmanship—a battle for America's gold standard among luxury motorcars. Cadillac was trying to outdo Lincoln, and it succeeded in every way, including losing money.

Nor was this particular Cadillac the first to do so. General Motors' luxury division managed to lose plenty during the Great Depression, and at one time GM executives briefly considered dropping Cadillac Div. altogether. Part of the reason was the drain placed on Cadillac by the marvelous but very expensive 16-cylinder engines introduced in January 1930.

The first-series V16—and the V12 adapted from it in September 1930 by lopping off four cylinders—cost the company an estimated \$6 million to tool plus several million more to put into production. The engine necessitated a lengthened and deepened frame, longer hoods and fenders and different



springs. So again, while there's no accessible record telling how much the V16/V12 program cost Cadillac in all, you can bet it was plenty.

Cadillac's president, Lawrence P. Fisher, planned to use the V16 as ammunition against Packard. Throughout the late 1920s, Packard reigned as the absolute monarch of elegant American motorcars. Duesenberg launched the huge and powerful Model J in December 1929; Marmon had an aluminum V16 up its sleeve for 1931; and Fisher knew that if Cadillac didn't want to stay a bridesmaid all its life (throughout the '20s, Cadillac ranked fifth among prestige cars, well behind Packard), it had better come up with something spectacular. Which it did, in the form of the narrow-vee 1930 V16.

That first Cadillac overhead-valve engine had an aluminum block, cast aluminum pan and rocker covers, and the first hydraulic valve lifters in U.S. production history. It amounted to two Straight Eights on a common crankshaft. Each bank had its own intake and exhaust system, complete with separate updraft carburetors. The coffee-can-sized distributor used twin coils embedded in the radiator header tank. The engine itself was a work of art, beautifully detailed in polished aluminum and black, uncluttered by loose wires or unsightly plumbing.

### Too late to pull back

This engine—and the mostly Fleetwood-bodied cars it powered—had been planned several years before the stock-market crash. By the time Black Tuesday rolled around, it was too late to suspend production. The V16, though, and its spinoff V12, nearly bankrupted Cadillac, and it was only the solvency of other GM car divisions that saved the marque.

The senior Packards (V12s and Super Eights) didn't have any such corporate health plan, nor did Pierce, Duesenberg, Marmon and some of the other luxury cars that burst into the '30s and then promptly self-destructed. These great cars were "Edsels," too, in their own quiet ways.

Well, Cadillac didn't stop with the first-series V16s. After managing to sell only 3,878 of these fantastic cars in eight Depression years, but determined to get to the top of the luxury ladder, with Packard still twitching, Cadillac discontinued the magnificent first-series V16 at the end of 1937 and introduced yet another V16 for 1938.

This newer engine shared absolutely nothing with the first one. It was a flat-head design, all iron but 250 pounds lighter, with a 135° vee angle instead of the 1930-37 model's 45° vee. It mounted two downdraft carbs up top, had twin distributors, and delivered no

more horsepower (185 at 3,600 rpm) than the engine it replaced. It was, though, less expensive to produce, and yet, since Cadillac discontinued the series after 1940 and 508 cars built, GM lost a bundle on that V16, too.

As an aside, Cadillac hoped the 1938 V16 might eventually power PT boats. If it had, the division might have showed a profit on this engine.

### More bombers than boomers

By now you might suspect that the auto industry spawned "Edsels" galore during its long and diverse history, and you're absolutely right. Statistically there have been far more bombers than boomers, and that's why, of the 5,000+ American makes introduced over the years, only a handful from four major manufacturers survive.

Taking a further look at some of the majors, consider first the company that at one time produced the king, queen and prince of American classics: the Auburn-Cord-Duesenberg triumvirate of Indianapolis and Auburn, Ind. All three automobiles have been or are being reproduced as replicas today, which tells you something about the transient nature of success. But the darling E.L. Cord, who brought these marques to their highest flowering, had a trio of financial flops on his hands.

Great as his cars were, the public either couldn't afford them or didn't want them, even though the Auburn ranked among the genuine bargains of its later years. You could buy an Auburn V12 in 1932 for \$1,595 or a supercharged Auburn speedster in 1935 for \$2,245. Try that today!

Again, there's no way to tell exactly how much money A-C-D lost during the '30s, but it had to run to eight figures at a time when eight figures could buy entire nations. Remember that in 1933, a Ford V8 sedan cost \$560. By way of contrast, a 1933 Duesenberg J chassis went out the door for \$9,500, with a custom body costing at least that much again. No wonder Cord sold only 475 Duesies between the Model J's intro in 1929 and its last gasp in 1937. And on a car that hyper, you've got a lot to lose.

The J and SJ (S for supercharged) Duesenberg had no equal anywhere in the world. It out-rolled Royce and outran absolutely everything, easily beating the contemporary supercharged Mercedes. Its Straight Eight engine used twin overhead cams, four valves per cylinder, with a displacement of 420 cu. in. A Roots-type supercharger was added in May 1932, boosting power from 265 to a published 320 hp at 4,750 rpm (this horsepower figure is oft disputed; some claim it's high, some low, and factory-modified models are

*(Please turn to page 152)*



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## AUTOMAKERS WHO DARED

(Continued from page 151)

said to have produced up to 400 hp).

At any rate, Ab Jenkins took a stock-engined but special-bodied Duesenberg roadster to Bonneville in 1935. There he posted 152.15 mph for one hour and averaged 135.47 mph for 24 hours—in a 142.5-inch-wheelbase car weighing nearly 6,000 pounds!

Of the approximately 475 Duesenbergs built by the factory, each one became a loss leader of monumental proportions. Yet each brings between \$100,000 to \$500,000 today from col-

lectors. Too bad Cord couldn't have simply warehoused his run of Duesies for half a century!

His front-drive Cord automobile turned out to be another magnificent money loser. As with Duesenberg and Auburn, Lycoming produced the Cord's engine, in Cord's first generation as an L-head Straight Eight (1929-32) and later an L-head V-8 (1936-37).

Here, again, was a car completely new from the ground up, sharing nothing with any other make. Cord tooling costs remain undocumented but must have been in the millions. Sales remained desperately low: 4,430 Cord

L-29s sold in 1929-32 and 2,320 Models 810 and 812 for 1936-37.

Auburn did a little better, but not enough. Ironically, that division's best year was 1931, with nearly 30,000 sales. Between 1929 and the end of 1937, in fact, Auburn managed to sell a grand total of just over 88,000 cars—almost enough to keep the company afloat through the Depression. But those sales tailed off toward the end, and cash flow must have been pulled down tremendously by the foundering Duesenberg and Cord. A-C-D expired peacefully in 1937.

Another daring and costly experiment that failed was Chrysler's beautifully ugly Airflow of 1934-37. The Airflow became another wrong-time launch, but its failure had as much to do with its looks as its timing. A very rational and well-thought-out design, it was among the first of U.S. cars to place the engine *over* the front axle and thus the rear passengers *ahead* of the rear axle. It also used a unitized, all-steel body and first introduced Warner Gear's transmission-mounted overdrive. The Chrysler and DeSoto Airflows were highly influential cars from an engineering standpoint, and they perhaps even influenced international styling to some extent, but the public couldn't abide them. Airflows were made on a variety of wheelbases, from DeSoto coupes to Imperial limousines, so they weren't inexpensive to tool and build.

### Different problems

Preston Tucker tried to bring another revolutionary car to market but ran into problems of a different sort. Unlike the Airflow, public enthusiasm for Tucker's 1948 Torpedo sedan ran high. The car had greatly advanced styling, with a "cyclops" central headlight that turned with the front wheels. It used an aluminum, opposed, six-cylinder, 334-cu.-in., 166-hp engine built by Franklin for Bell helicopters. The engine was converted to liquid cooling and lay lengthwise at the rear of the car, mated to a remanufactured version of the old Cord preselector transaxle. Tucker got most of these transaxles from wrecking yards.

The Tucker car stood very low for its day, and it had some other revolutionary eye-catchers, among them a "basement" or crash compartment that the front-seat passenger could throw himself into just before a crash. Doors lapped up into the roof for greater head clearance. And the trunk, of course, was under the hood.

Preston Tucker built some 50 cars before the U.S. Securities and Exchange Commission closed him down on purported stock-fraud charges. Meanwhile, his auto venture had put Preston Tucker some \$28 million in debt. He died in South America in 1956



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while trying to start up an auto-making company. It's generally agreed that he probably won't even if he'd absorbed even the Edsel and concrete lack of his case. Ruvivable in cred- man Joseph W. front-wheel-drive suspension. Proto- at configuration, settled on conven- using a Continental

he. Malcolm Bricklin, on the other hand, freely admitted he didn't know what he was doing when he decided to raise money to build a gullwing sports car bearing his name.

The Bricklin was a fairly modest bust by modern standards—only about \$26 million in the hole. Malcolm Bricklin might have been on his way to profitability given a little more time, but the New Brunswick government and U.S. banks turned off the spigot before anyone got a chance to find out.

The Bricklin SV-1 used a hefty perimeter frame with integral rollcage, fiberglass body and front-mounted AMC or Ford V8s. Cars were announced in 1975 at \$9,980, but each one cost the company up to \$16,000 to build. In all, Bricklin produced about 2,800 cars.

Perhaps you can't even call the Bricklin and De Lorean American cars, since both were produced outside our national borders. But the men who founded these companies were archetypal American entrepreneurs who operated in what's come to be described as a typically American way of launching a new car. Unfortunately, as each entrepreneur fails, he makes it that much harder for anyone else to follow.

Contrast all these expensive ironies with one of the great recent success

stories of international carmaking, namely Honda. Whether Honda had Japanese government backing for its car venture I don't know, but the company went into the auto business in a very un-American way, with very little hoopla, no grandstanding and virtually no announcement of plans. Honda just started building cars.

In this country, Honda's first two models turned out to be about as successful as the De Lorean and the Edsel—the tiny S.600 roadster of 1962 and the N.360 of 1968. But unlike De Lorean, Honda had the money and thus the time to keep going, and you can see what that led to: Honda now builds cars in America. It is a strange business, even for established auto manufacturers—and certainly no place for the novice or faint-hearted. **FM**

### Credit Where It's Due

I'm fully aware that my article ignores successful specialty car builders like the SS Corp. of Milwaukee, which manufactures the Excalibur, and the Elite Heritage Motorcar Corp., makers of the Due-senberg II. With due respect, my article concentrates on companies that at least tried to enter the world of mass production and marketing, and I've intentionally sidestepped the successful but mostly handcrafted marques from the smaller specialty car producers.—M.L.

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## FIRSTHAND REPORT

*Aimed at Econosport market, Pulsar features pop-up headlights and no grille. Just five slots provide fresh-air intake.*



# Driving The Nissan Pulsar

Nissan has another flavor in its jellybean jar.

BY DON FULLER

**N**issan wants to be your car company. When you walk into the dealer's showroom, Nissan wants there to be such a terrific selection that you won't be able to resist.

Did you ever walk into a Baskin-Robbins and not have at least one of those 31 flavors? That's Nissan's approach—lots of automotive flavors.

With the bread-and-butter Stanza and econoleader Sentra, Nissan has embarked, within the last year, on the path to front-wheel drive. In the sporty mid-size coupe market, the veteran 200-SX, with or without turbocharger and for two or four people, fills the sports car slot. But Nissan felt there was a gap between the Sentra and Stanza, now plugged by the newest front-driver, the Pulsar.

This new model is notched somewhere between the Sentra and Stanza in price. It's closer to the Sentra in size and skewed more toward the sporting side of the scale. Thus, Nissan offers sedans from bottom to top and sporty cars from low through middle to high.

The Pulsar will be available in three body styles. Introduced last November

as a 1983 model, the NX coupe is the sport version. Due for introduction in a month or so are three- and five-door hatchbacks. They're on the conventional side, but should be perceived as sportier and more desirable than the Sentra. The NX is slated to make up about 60 percent of total Pulsar production.

In Nissan's line, the Pulsar replaces the 310, a design in the tradition of the, uh, *unusual* styling of such memorable Datsun efforts as the F-10, original 200-SX and B-210. The NX coupe seems to have followed that unortho-

dox tradition. Styling is entirely a matter of taste, but I think the NX looks like one of those homebuilt balsawood model cars I made as a kid—after I sawed it out, but before I sanded it off.

Mechanically, the Pulsar holds more promise. The engine is Nissan's E-series, a four-cylinder design shared with the Sentra. An already undersquare engine reflecting Nissan's emphasis on compactness, low-end power, emission control and high mileage at the expense of performance and smoothness, it's been stroked even

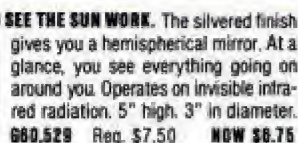
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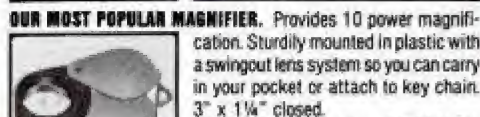
*The Pulsar coupe will soon be joined by new three-door and five-door hatchbacks.*



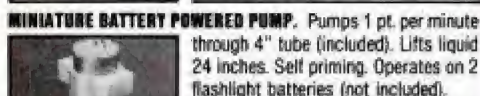
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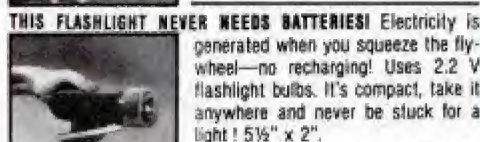
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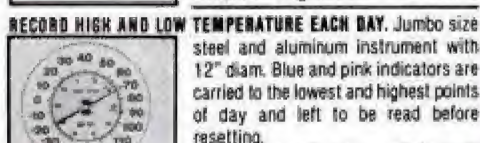
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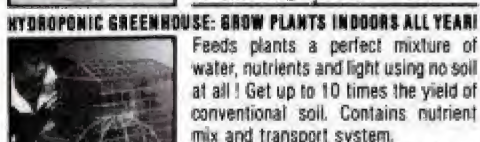
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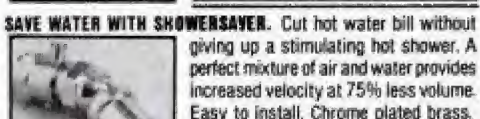
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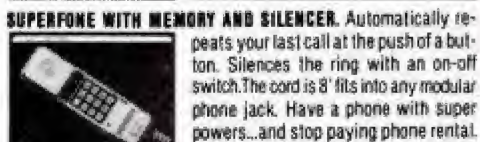
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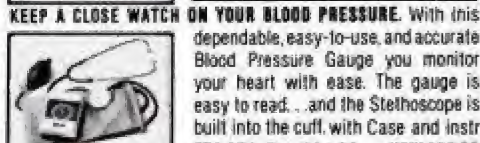
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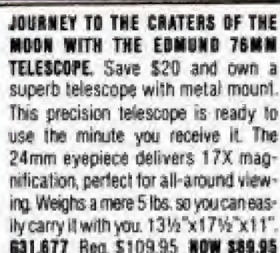
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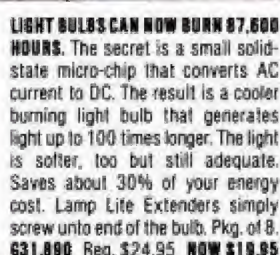
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## DRIVING THE NISSAN PULSAR

(Continued from page 154)

more to make 1.6 liters. It has a two-barrel carburetor, belt-driven overhead camshaft, and churns out 69 hp at 5,200 rpm with 92 ft.-lb. torque at 3,200. The engine is redlined at 6,000 rpm, but pulls comfortably only to about 5,000. The last 1,000 is noticeably buzzy, but few Pulsar owners will ever see their cars' tach needles in that part of the dial. Due to refinements, it's more responsive and predictable than in the earlier Sentras and it goes about its chores willingly.

Nissan should be given good marks



The car's interior is comfortable and well assembled. There's plenty of headroom, front and rear, due to high roofline.

for the transmission, a five-speed with a single-rail-type shifter. Gear selection is smooth and precise and two springs, a soft one on the first/second side and stiffer one on the fifth/reverse side, keep the lever properly centered in the third/fourth slot.

The chassis is essentially a refined version of the 310, with struts in front and trailing arms in the rear. There are coil springs all around, tubular shocks, a front antiroll bar, front disc brakes with drums in the rear and rack-and-pinion steering—all pretty standard fare.

The NX's behavior is also predictable. In the interests of maximum fuel economy the gearbox ratios are wide, with both fourth and fifth overdrive. Fifth is for freeways only, and third is the choice for around town and passing. The ride motion on asphalt is decent enough, but on concrete freeways, it's less pleasant. The car has trouble with expansion joints and lane divider dots, and so a trip down the interstate is a jiggly one. The NC also doesn't do very well on railroad track crossings. Although the hatchbacks may be slightly better, it seems Nissan engineers could stand a trip back to the computers to improve spring rates and shock absorber valving.

Handling is a different story. The Pulsar's steering is direct, if devoid of good feel, and the overall cornering

(Please turn to page 158)



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a true story by John B. Haikey

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"I managed to raise enough money with my savings to invest in a combination motel, restaurant, grocery, and service station. It didn't take long to get my eyes opened. In order to keep that business going my wife and I worked from dawn to dusk, 20 hours a day, seven days a week. Putting in all those hours didn't match my idea of independence and it gave me no time for my favorite sport—golf! Finally we both agreed that I should look for something else.

"I found it. Not right away. I investigated a lot of businesses offered as franchises. I felt that I wanted the guidance of an experienced company—wanted to have the benefit of the plans that had brought success to others, plus the benefit of running my own business under an established name that had national recognition.

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"Well, that's the business I was able to start with such a small investment. That's the business I built up over a period of eight years. And, that's the business I sold out at

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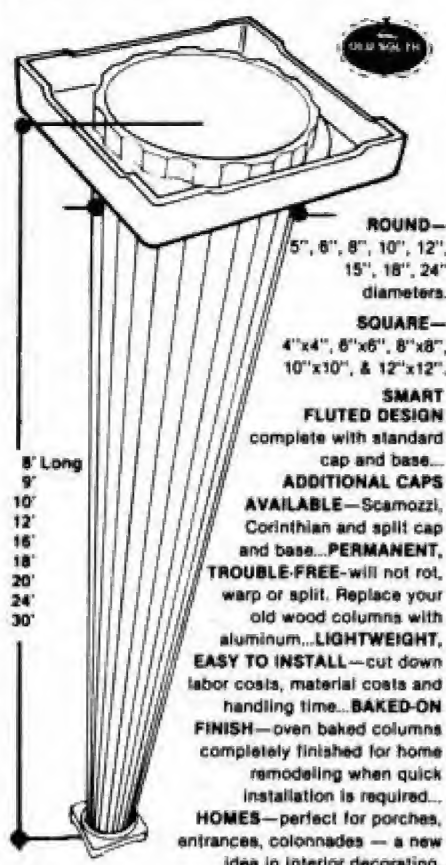
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## DRIVING THE NISSAN PULSAR

(Continued from page 156)

behavior is quite close to neutral for a front-wheel-drive car. Since there is no rear antiroll bar, this handling attitude may be due to stiffer rear springs and other tuning measures which could explain the less charming aspects of the freeway ride.

Still, what matters most are the mileage numbers the EPA allows a company to advertise. Nissan told its advertising agency to print up some nice, big ones for the Pulsar. The three-speed automatic will register 31 mpg in city, 39 on the highway. The five-speed offers 35 in the city and 50 on those jiggly highways.

For a high-mileage car, the NX carries a pizzazz interior. It's color coordinated and everything fits. There's a tachometer, detachable sunroof, 175/70 white-letter radial tires, full wheel covers, AM/FM stereo, halogen headlights, quartz clock, remote trunk and gas-cap door openers and rear-window defogger, among other features. The only options are automatic transmission and air conditioning.

The seats recline in small increments and the steering column is adjustable for height. Vision is good out the front, to the sides and directly to the rear through the large, rectangular back window, but not so wonderful to the rear three-quarter. The large rear pillar obscures a good portion of the scenery when you glance over your shoulder to change lanes. The remote adjustable mirrors move backwards—move the handle in to move the mirror out—and on the cars I drove, it couldn't be adjusted upwards enough to see much more than pavement. The high rear roofline offers adequate headroom for most people and overall quality appeared to be first rate.

### Mixed reactions

The bizarre NX styling provokes mixed reactions. The people I talked to whose business involves knowing about cars thought it was pretty awful. But those not in the automotive field tended to like it.

Essentially, the Pulsar, is a Sentra that's a little bit shorter and a little bit heavier. It delivers the same EPA fuel economy from the same powertrain, should have identical performance, carries a sportier image with more features and "product content," and costs more money. Retail of the NX is \$7,399, and when the hatchbacks appear, they'll probably be in the region of \$6,500 to \$7,000. The Sentra is priced from \$4,949 to \$6,599.

In a way, it's a low-buck Honda Prelude—just one more of Nissan's 31 flavors in the car store.

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## FIRSTHAND REPORT

*Fast, agile and now with a ragtop, the 911SC stands as the last of Porsche's rear-engined cars.*



# Driving The Porsche Cabriolet

For the first time in 18 years, there's a Porsche with a ragtop.

BY CLIFF GROMER

**A** Porsche snapping through the tight turns in the mountains of Southern California is a common sight. The one I was driving, however, was no "ordinary" coupe or Targa. It was a new convertible (Porsche calls it a cabriolet)—the first drop top from Porsche in 18 years.

Why a convertible, er, cabriolet? Well, there's something special about true open-air driving in a thoroughbred sports machine. As a matter of fact, some Porsche Targa owners have shoveled piles of money over to shops that specialize in sawing off the Targa top and installing a folding soft top.

The Porsche factory also uses the basic Targa chassis for its soft-top derivative. Basic structural differences between the two models are minor. The motor support area is beefed up slightly

for added rigidity, and there's a new routing of the fuel line.

The folding top, weighing some 30 pounds less than the Targa system, is manually operated. Porsche promises that an automatic version is on the way. Two removable handles plug into sockets to unlock and lock the top in position. Large recessed handholds help you grip the top for easy raising and lowering. The rear window is zippered so it will lay flat when you're stowing the top, or for added ventilation when driving with the top up.

The top is supported by a three-bow frame and uses spring-loaded tension cables for a snug fit. Unlike its lesser cousin, the VW Rabbit convertible, whose top in the down position resembles the Great Wall of China, the Porsche top tucks neatly out of the way. You get a boot that fits over the folded top for that final tidy touch. A tonneau cover costs extra.



*With top up, the lines conform to that of the hardtop.*

The rear seats (a generous term at best) have release buttons so the backs can fold down when raising or lowering the top. The seat backs are angled forward more sharply in the Cabriolet than in the other 911s, making them even more uncomfortable than usual. The rear seats may be perfectly okay for small kids who don't know any better, but they're definitely off-limits to adults.

Working the top is hassle-free. It's a one-man, five-minute deal. When locked in place, you can forget about annoyances like the top flapping, wind


*(Please turn to page 162)*



# Powerful Portable Workshop In A Suitcase

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A black and white photograph showing a person from the waist down, wearing white protective gear (possibly a hazmat suit or cleanroom suit). They are carrying a large, black, rectangular case or toolbox under their right arm. The background is slightly blurred, suggesting an outdoor or industrial setting.

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The motor is hermetically sealed, making the PowerHead virtually rust proof and dust proof, adding tremendously to the tool's life. Plus, a 12-pole motor for really smooth running and a high efficiency, low loss magnetic-iron armature, are features that turn energy into torque and horsepower, instead of heat, again making the unit more efficient. Permanently lubricated helical gears make the unit almost indestructible and enhance the

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**SABER SAW**

Steel base tilts 45° right or left for bevel cuts. Includes three blades. Full half inch stroke.

power to drive the Quick-Attach, add on accessories.

The PowerHead is designed to deliver the maximum power with the minimum power drain. Even after many hours of working with the tools, you will have more than ample starting power left in your battery!

Consider the convenience, versatility and reliability due to excellence in design and material quality. Once you've used POWER MAX tools, you will agree that this set is the most important, specialty portable power tools you'll ever own!

## The only outdoor enthusiast's total power tool set

Drill effortlessly thru wood, power your way thru Masonite or even steel. Remove the 3/8" German made chuck, screw on an adapter-nut, and you've got the PowerHead for driving the other tools. Quickly attach the circular saw and you've got the power to zip thru 2x4s. The saber saw can be attached upside down to any work table top (special clamp included), converting it to a jig saw, thus allowing both hands to be free to saw.

Also included in the set are a 1 - 2 1/2 inch hole saw; a five inch disc sander/polisher; a pack of 10 sanding disks; special 16 1/2 foot extension cord; a depth guide for the drill; a pack of three (3) saber saw blades; two (2) circular blades (28 and 80 tooth); three hex keys; 1 drill chuck wrench; adapter nut and a chuck key.

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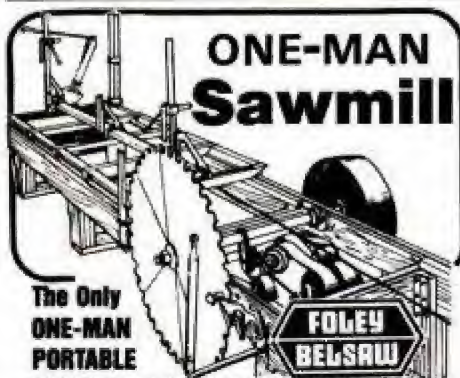
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## PORSCHE CABRIOLET

(Continued from page 160)

whistles or water leaks. Credit for the top's excellent stability at any speed and its safe-like sealing security goes to a steel plate installed beneath the front section of the cloth top. And the top is so designed that its shape conforms to the 911's swoopy, sexy lines.

Underneath the soft top is pure 911SC. Unlike the more civilized, but very roadworthy 944 and the luxury starship 928, the 911 is the only Porsche for the hard-core enthusiast of the marque. A direct bloodline descendant of the classic 356 model, the 911SC embodies all that the good Dr. Ferdinand intended the car to be—and then some. The 911 may be more challenging to drive compared to the other models but, according to the purists, oh so much more satisfying.



The interior of the Cabriolet is typically German: taut, crisp and well engineered.

The business end of the 911SC is the rear, where, according to tradition, you'll find the engine and transaxle. This makes for a rear-favored weight bias which can cause the car to be unforgiving at times. You'd be surprised at how white your knuckles can get when the back end unexpectedly decides to come around in a sudden blitz of oversteer.

The rear location of the transaxle also results in a long gearshift linkage which can make for vague gear engagement. At times, you feel like you're probing with the stick to see what gear you'll finally spear.

A drawback of design? Perhaps, but the traditionalists would have it no other way. They say that once you get used to the quirks of gear changing, it spoils you for anything else. Unfortunately, Porsche wouldn't let us keep the car long enough for us to be spoiled for anything else.

The concept of the 911SC is a serious sports machine that has high regard for comfort and even luxury, as well as performance. Few compromises have been made that would dull the razor reflexes of the machine.

The cockpit, cobbled in black leather, is all very businesslike—no frills or

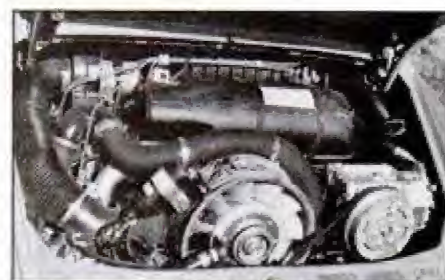
doodads, just plain, readable, aircraft-style instruments, white numerals on black faces. The 911 resists the current trend of some carmakers to see who can come up with the trickiest digital readout or the most spectacular display of aurora borealis dancing lights for the dash. An exciting instrument panel is a poor excuse for a boring driving machine.

The front bucket seats are firm and comfortable, and give excellent support, especially in the lower back area. Lateral support is very good without using those cumbersome side wings that want to come around and digest you like a Venus' flytrap.

The footwells are small. You have to hunt for room to park your left foot. The bulge in the left side of the footwell doesn't help matters either, and it displaces the clutch and brake pedals slightly to the right of where you'd expect them to be. Something else to get used to.

Inserting the rather long ignition key into the lock is like stabbing the dash with a short bayonet. A quick twist to the right, and the flat Six responds with an enthusiastic exhaust. The clutch is another no-compromise item. It's either in or out. There's no soft, gradual range of engagement. Let up on the pedal and the engine hooks up *right now!*

And there's certainly nothing soft or gradual about the 911's power curve. Come off the line hard, and the 911 punches you back into the seat. First gear response, with its stiff 3.18 to 1 gearing, has all the alacrity of a whip crack. The brutality slackens some as you power through the milder-ratioed upper gears, but it always remains spirited.



The very willing six-cylinder boxer motor is good for an observed 120-mph top end.

Acceleration is brisk up to an indicated 100 mph and then falls off before topping out at 120 mph. This is some 20 mph below the car's advertised top speed, and we don't know if Porsche lovers quibble about this sort of thing or not. It's certainly good enough for us in this day of the 55-mph limit.

Steering response, handling and braking action are what total performance is all about. It's what the 911SC was made for. All the controls are very

(Please turn to page 164)



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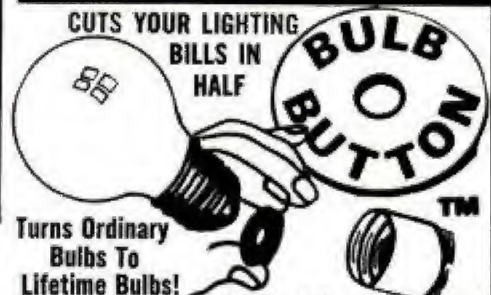
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## PORSCHE CABRIOLET

(Continued from page 162)

direct and quick-acting. The four-wheel ventilated disc brakes could lock the wheels at any speed in straight-line stop. A series of panic bounces on the brake pedal at 70 mph was simply shrugged off by the car.

The suspension system is well sorted out, as indeed it should be. After all, Porsche has been playing around with this car's basic design since 1948, with the first of the 911 series going on sale in this country in '64. The current arrangement uses MacPherson struts (sans springs) combined with adjustable torsion bars on the lower control arms in the front, and semitrailing arms with torsion bars at the rear.

Making the most of the suspension technology is a wide footprint of Pirelli P7 rubber. The low-profile 55-series skins in front, and 50-series on the rear, all mounted on 16-inch wheels, do their part for maximum handling and steering response. The narrow sidewall flexes less and so gives more direct input to the wheel. An excellent tire overall, the P7s tended to "nibble" or pull at the wheel slightly. The steering wheel also picks up road vibration and kicks back on rough roads.

When you get tired of playing road racer, just plot the gear lever into FIFTH and sit back for low rev, quick highway cruising and 25-mpg economy. Even though the 911 is set up with a bias toward the sporting, overall ride quality keeps fatigue at bay.

### Nothing hangs loose

Fit and finish are buzzwords that have been beaten to death in recent times. American consumers have developed tendonitis by pointing their fingers at Japanese products while shaking their fists at Detroit. Well, the Germans were experts at the game long before the Japanese came out on the field. And there's been no slacking off at Porsche. You just don't find rough edges, missing fasteners, or things hanging loose. Paintwork is show quality. Indications are that the 911SC Cabriolet will price in at about \$36,000.

What does Porsche plan as an encore for its venerable 911 series after its Cabriolet act? The factory currently is working on redoing the Turbo model, but there are no plans to drop the boosted engine into the Targa or Cabriolet. These bodies are not rigid enough to handle the extra power. So for the time being, at least, 911SC fans will have to make the most of the present mill which makes a healthy 172 hp at 5,500 rpm and 189 ft.-lb. of torque at 4,200 rpm from a 2.9-liter (183-cu.-in.) engine.

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You've never seen anything like it. Homeowners from coast to coast report astonishing growth rates you can actually measure as the days go by! Order now, and your trees can enjoy the full growing season that Mother Nature intended. They can quickly grow up to **eight feet the very first year!** That's half the size of a mature Dogwood! And, that's just the start. It can **hurtle up to 14 feet the second year.** In no time at all, your tree can mature to heights of **over 60 feet tall**, with its dense, leafy branches spanning up to **35 feet wide!** Few other shade trees can match this phenomenal growth speed. And best of all, no special attention is needed to achieve this fast skyrocketing growth and magnificent beauty.

### DEVELOPED BY SCIENTISTS FOR FAST, SURE GROWTH IN VIRTUALLY ANY SOIL, EVERYWHERE IN AMERICA — WITH NO SPECIAL CARE!

As a result of over forty-six years of U.S.D.A. Forestry department of testing research, you can rest assured that this tree will grow fast and well for you. Unlike fussy fruit and nut trees, which require spraying and pampering, this super-growing hybrid is **NATURALLY RESISTANT TO MANY DISEASES, PESTS OR INSECTS.**

Now stripped of their official Government test number N.E. 41, in favor of the designation - **PRESTO POPULUS GIGANTEUS (Androscedrin Cultivar).** These wonder trees

### "...Six Times the Growth Yield of Other Trees..."

-Ontario Ministry of Natural Resources-

are so easy to plant that even a child can do it!

These trees have proven themselves from rocky, acidic coal-mine slopes to the hot, humid tropics of the Gulf of Mexico, to the bitter, ice-bladed prairies of Canada. These trees...

- Require no special attention aside from regular garden care!
- Thrive in such hostile areas as mine-spoils and reclaimed sanitary landfills!
- Shrug off the effects of frigid winters!
- Need no special pruning or spraying!

Remember, results will vary with each locality. Trees take just moments to plant, and will reward you with years of quick growth and beauty...starting this very season.

### SURGES INTO A BEAUTIFUL SHADE TREE IN A MATTER OF MONTHS

Picture your family sipping ice-cold lemonade on the hottest day of summer...cool and relaxed beneath the spreading limbs

of one of the greatest scientific advancements in the world of trees. With so many fantastic attributes, it may be the **finest shade tree ever!** Now, picture your patio or lawn becoming the neighborhood show-place. This ornamental beauty stands straight and tall spreading the skies with Olympian vigor! You lay stretched out on your hammock beneath branches and boughs heavy with gorgeous green foliage that throws a massive "Beach Umbrella" over you. Recline in comfort with your favorite magazine...and **beat the heat!**

Best of all, is knowing that generations of your family will enjoy these strong, spreading, friendly branches that youngsters love to climb on. And generations of loved ones will be good-naturedly boasting to their neighbors and friends about how quickly this super-growing hybrid grew. And, how long this astonishing tree has been "like a member of the family."

### YES, THIS TREE CAN EVEN SAVE YOU DOLLARS AND MAKE YOU MONEY!

Nothing else you can plant can guarantee you practically immediate relief from your fuel bills!

- They'll block the blistering summer sun-Average 10° cooler on hot, sunny days!
- National Realtors estimate average \$2,000.00 additional value to your home when landscaped!
- When the leaves drop in the fall, the sun can easily penetrate and help in heating your home!
- Leaves make excellent garden compost!
- This same Wonder-Hybrid is nationally recognized as a superb source of firewood-energy!

In fact, the very same tree that we now offer you for planting in your yard is being planted by the thousands of acres for firewood purposes! The reason? An estimated 59.8 Million BTU's of energy per acre. More heat than OAK, MAPLE OR HICKORY!

### HOW TO GET YOUR TREES - FOR LESS THAN A CAN OF COFFEE!

That's right! Though you may think, and rightfully so, that a tree with this kind of pedigree, that grows this beautiful, this fast...just has to be expensive. Normally, you'd be right. But, we have a source close to the U.S. Gov't. hybrid program. And, if you order now, through this publication, you can completely forget about astronomical prices. **THE TOTALLY UNSURPASSED OFFER:** You may purchase two of these certified hybrid trees for just \$5.95. Less than a 3-lb. can of coffee! Elsewhere, quality shade trees cost you many times more, but only through this ad, your price is just \$5.95 for two trees.



By the first year — already a man-high source of beauty and amusement to all who witness the amazing growth speed! Up to a FULL FOOT PER MONTH!



The third year brings cooling shade to comfort the entire family — even on the HOTTEST DAY OF THE YEAR! The beauty and astounding speed of growth really have the neighbors talking!



In its fifth year, your tree's densely foliaged limbs span up to 35 feet wide! And not only gives the whole family shade and enjoyment, but is also the most beautiful shade tree on the block.



**THIS TREE IS THREE YEARS OLD!** When this little girl was born three years ago, this Hybrid Populus tree had just been planted. Now, as they're both celebrating their 3rd birthday, the tree stands a stately 20-foot tall. This graceful Super-Thriving tree will give you virtually instant shade, and can add value to your home. Read this article on its Amazing Development, now presented for the FIRST TIME.

### WE GUARANTEE YOUR SATISFACTION TWO WAYS

If you feel that this gorgeous growing marvel just isn't for you... if you're not satisfied in every way with these quick growing shade trees, simply return them to us within a full three months of shipment for a full refund of the purchase price... ANYTIME WITHIN THE NEXT YEAR FOR FREE REPLACEMENT! What could be fairer?

### ORDER NOW - RISK FREE OUR SUPPLIES ARE LIMITED THE DEMAND IS GREAT

Because this wonder hybrid is so new, we're naturally limited on the number we can sell this year. So order now, and start enjoying what's virtually the fastest growing shade tree known to man... this very same summer! (Not available in Canada) ©1982

**SUPER SHADE TREE**  
Nursery Division, Dept. G-509  
710 Norwood Lane  
Canton, Ohio 44750

**YES, please send me this extraordinary, beautiful, FAST-GROWING shade tree: the PRESTO POPULUS GIGANTEUS.** I understand that if I'm not fully delighted, I may return the trees within 90 days for refund of my purchase price (less postage and handling), or free replacement. (Limit 50 trees per family.)

- ☐ 2 Trees for only \$ 5.95 plus \$1.20 postage & handling
- ☐ 5 Trees for only \$ 7.80 plus \$1.65 postage & handling
- ☐ 10 Trees for only \$12.50 plus \$2.00 postage & handling
- ☐ 25 Trees for only \$21.85 plus \$3.10 postage & handling
- ☐ 50 Trees for only \$39.95 plus \$5.00 postage & handling

**CHECK ONE**  
☐ Cash, check or money order (Make checks payable to Super Shade Tree)  
☐ Charge my ☐ MasterCard ☐ VISA

Acc. No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

Total amount enclosed \$ \_\_\_\_\_  
Ohio residents add 5% sales tax. Sorry, no C.O.D. orders accepted (please print)

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Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Order your Trees now. They'll be shipped at the U.S.D.A. recommended planting time for your neighborhood. And, you'll receive a free growing guide!



\$443.00

# The Bike That Ate Up New York City

Conceived as a 'mountain bike,' the fat-tire flyer is the ideal commuter conveyance in a city where most of the streets are definitely off-road.

BY ROBIN NELSON

**T**he man was in a hurry. He'd already paid the cabdriver, so when the yellow monster cut me off as it pulled in toward the curb on New York City's busy Central Park West, I had nowhere to pass but on the right —braking just wouldn't do the trick. As he flung it open, the cab door caught the Stumpjumper's left handlebar (fortunately, inboard of my hand) as I roared by. I did a passable one-and-a-half in the pike position, with a glide ratio of about four to one, and hit the asphalt on two points—helmet and right shoulder. This, for the uninitiated, is bicycle commuting in New York City.

After I had gotten clear as to time of day, my name and other vitals, and vainly pursued my assailant into the lobby of a doorman-guarded apartment building, I started looking for something in which to put pieces of bicycle. But once again, I had underestimated the Stumpjumper. The handlebars were slightly cocked. I straightened them by hand, got on and rode off (a trifle shakily) on the same sure-footed, fat tires with the same quiet, smooth, 15-speed drive train. Some things still manage to work in this world, and this so-called "mountain bike," a durable machine that a har-

*(Please turn to page 180)*



*Riding against traffic (above) is not our normal mode; here a quick fat-tire flyer U-turn helped get us out of a real New York traffic jam (and let our photographer get exactly the shot that he wanted).*

*Sewer grates (far left) are death to the normal 10-speed, thin-tire format, seen next to our off-road fat tires which really pull through.*

*Stumpjumper also conquered the tough crags of Central Park (left); after all —it's a "mountain bike."*





# Bionic "Ears"

Tiny, powerful electronic sensors give you superhearing — through walls, up to 1/2 mile away.

## The Dyna-Mike Transmitter

It's smaller than a quarter. But DYNA-MIKE will transmit every sound in the room to an FM radio tuned to the proper unused frequency, up to half a mile away.

If you're at a neighbor's home a block from your own, you can hear your baby's cry, or you can tell the instant your spouse comes home. If two of you are driving tandem in two cars, one or both of you can communicate with the other even if other cars drive between you.



DYNA-MIKE has as many uses as your imagination can think of. For a business conference, let the tiny microphone sit unobtrusively on the table or concealed on a shelf, and you'll be able to record every word. For businesses, put an FM receiver in a warehouse or remote office and "broadcast" instructions or orders to be filled.

Public speakers never had a better friend than the DYNA-MIKE. No wires or setup — just turn on one or more radios and your speech will come through with perfect fidelity. Put one on the front porch. If you hear a suspicious sound, turn on the radio and you'll hear the doorbell or even a muffled conversation.

### Choose Your Model

New Horizons is introducing three models of the DYNA-MIKE supersensitive broadcast microphone. Model AR-7 is the world's smallest microphone, it's a miracle of electronic miniature power, with a range of 750 feet and a battery life of 90 hours. Introductory price is \$129.95 (two for \$119.95 each).

Model 9-DX is a long-range microphone, broadcasting an unbelievable half-mile distance. This miniaturized wonder is \$149.95 (two for only \$139.95 each). Normal battery life is 25 hours, or you can have the special Power-Pak, which operates 200 hours, for \$19.95.

The AR-7 and 9-DX are sensitive. They'll pick up sounds from 40 feet away. But for super-sensitivity, nothing beats the A-5.

The A-5 will pick up a whisper from more than 60 feet away and broadcast it to a receiver 750 feet distant. The A-5 comes with a special 200-hour long-life battery and is introductory-priced at \$99.95 (two for only \$89.95 each).

## The Telephone Voice Changer

It's right out of James Bond! Push a button and the VOICE CHANGER gives your voice completely different characteristics. The person on the other end of the phone won't know it's you.



The VOICE CHANGER is more than an "electronic handkerchief" — it doesn't cause your voice to sound filtered, it literally changes tone and timber.

Choose from two separate, distinct Changer Channels. If you're alone in a business office, it'll sound like an employee answering. If you live alone, you can get rid of pesky calls by pushing Channel 1 or Channel 2 and saying, "Sorry, that person isn't in."

### How It Works

The VOICE CHANGER is powered by two ordinary penlight batteries. One set of lead-in wires connects to your telephone base; the other clips to the wires leading to the handset.

Pushing the button labeled "Ordinary" puts your normal voice through the line. Pushing "Channel 1" changes timber and texture. Pushing "Channel 2" creates different characteristics from Channel 1. Thus you have three voice options — your own, plus two changed voices.

MAKE NO MISTAKE! THE VOICE CHANGER DOESN'T MUFFLE YOUR VOICE OR MAKE IT UNINTELLIGIBLE. It literally changes the quality of sound — space-age electronics at work.

Use the VOICE CHANGER to reach that doctor, lawyer, or business executive whose secretary knows your voice and who always is "out" when you call. Use it to screen your own incoming calls. Use it for just plain fun. Any time you like, during a conversation, push the "Ordinary" button and your regular voice returns to the wire.

The VOICE CHANGER is yours for \$99.95 — two for \$89.95 each (plus \$2.50 shipping per total order). When you consider the many uses of this brilliant electronic instrument, it's a real bargain. Of course it has the standard New Horizons guarantee.

## The Super Ear

You'll hear it all.

Effortlessly, you can hear not just a baby's cries, but quiet breathing — through a concrete wall a foot thick. Put the earphone in your ear and place the SUPER-EAR on the wall. That's all there is to it.

SUPER-EAR hears everything — and, even more astounding, hears it clearly. It's as though the wall weren't there. If you're coming home late at night and think intruders are in your residence, let SUPER-EAR find out for you. Want to know if the meeting is over in the room with the closed door? SUPER-EAR will tell you in a second.

SUPER-EAR is undetectable from the other side of the wall. The quality of sound has amazing fidelity — good enough to record, and SUPER-EAR has its own built-in recorder jack.

Because SUPER-EAR is the ultimate listening device, you can use it to pinpoint hidden squeaks in your car or the source of mysterious engine noises. Construction experts use it to check for flaws or cracks in buildings.

### It Works Anywhere!

Ever put your ear to a railroad track to try to hear the train? Try it with SUPER-EAR. You'll hear that train many miles away. Use it as a powerful stethoscope on yourself, a friend, or a pet. You can even hear a bird's breathing.

The only source for SUPER-EAR is New Horizons. Choose from two models — Model SB-5, with ultrasensitive microphone, \$139.95 (two for only \$129.95 each); or Model SB-1, with suction-type microphone, \$99.95 (two for only \$89.95 each).



## The Private Transmitter/Receiver

The NCZ-10 broadcasts on a special radio band. No one without equipment can hear your transmitted messages.

The reception is unbelievably clear and bright — commercial broadcast quality.

Your receiver clicks into any of three separate channels. In the suburbs the range is up to 2000 feet, and in the city 850 feet.



With your special receiver is an inconspicuous high fidelity earphone. You can put three transmitters in three locations and then switch back and forth, monitoring all three. Someone with an FM or police band receiver can tune his dial all day, but he won't pick up these signals.

With two receivers, you can have a complete two-way system without the inconvenience and annoyance of the semi-public CB channels. The NCZ-10 channels are private.

This professional-quality electronic miracle is easy to use and completely dependable. Monitor your baby's room. Leave a transmitter in an inconspicuous place in your office or your home, and you'll hear anything going on in that room.

One NCZ-10 receiver with one transmitter is \$279.95; with two transmitters (two separate bands), it's \$379.95; with three transmitters (three separate bands), it's \$479.95.

For a complete private communications system, order two receivers, each with a transmitter (we'll send them with different bands). Special high-performance batteries enable you to operate the receiver for 40 hours continuously, the transmitter for 35 hours.

### We Absolutely Guarantee!

Use any electronic instrument acquired from us for up to 30 days. If you decide for any reason you don't want to keep it, return it for a 100% refund.

### ORDER TOLL-FREE

For fast delivery on credit card orders, call toll-free 24 hours a day, seven days a week:

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Ask for Operator no. 551

(in California, call 800-852-7777)

Or send check or money order. Please add \$2.50 per total order for shipping. Order any or all these state-of-the-art electronic instruments:

- \* Dyna-Mike AR-7, \$129.95 (two for \$119.95 each)
- \* Dyna-Mike 9-DX, \$149.95 (two for \$139.95 each)
- \* 9-DX rechargeable power-pak, \$19.95
- \* Dyna-Mike A-5, \$99.95 (two for \$89.95 each)
- \* Super-Ear Model SB-5 microphone, \$139.95 (two for \$129.95 each)
- \* Super-Ear Model SB-1 microphone, \$99.95 (two for \$89.95 each)
- \* Voice Changer, \$99.95 (two for \$89.95 each)
- \* NCZ-10 transmitter and receiver, \$279.95 (two transmitters, one receiver, \$379.95) (three transmitters, one receiver \$479.95)

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# S-10 CONQU

**THE STOCK TRUCK WITH GUTS ENOUGH TO FINISH THE  
IS AVAILABLE THROUGH YOUR CHEVY DEALER NOW.**

On November 3, 1982, a Chevy S-10 Pickup—right off the assembly line—challenged the famous Baja 1000. It's the longest off-road event on the continent, running the length of the Mexican Baja peninsula. Over 985 miles of rocks, sand, dust and heat. A course so tough that even many specially equipped trucks did not finish.

But the new-size S-10 4X4, with optional V6 engine, the revolutionary new Insta-Trac 4-wheel drive, and optional Off-Road Chassis Package, entered with no special equipment except for safety items required by the sponsor. In fact, it was the *only* totally stock truck to enter. And for 37 hours, the S-10 took everything the



***TOUGH CHEVY TRUCKS***



# ERS BAJA.

## BAJA 1000

Baja could dish out.

Like all entries, the S-10 took its share of punishment. But at Baja, to finish is to win. Because in a field of 135 entrants, 70 could not even complete the course.

We think conquering the Baja says a lot about the way Chevy S-10s are built because

you can buy a pickup just like it—the one that conquered Baja—at your Chevy dealer's now.

Some Chevrolet trucks are equipped with engines produced by other GM divisions, subsidiaries, or affiliated companies worldwide. Ask your dealer for details.

Let's get it together...buckle up.

**CHEVY S-10** ★



**ARE TAKING CHARGE**





# Quick Guide To Speaker Repair

Here's what you'll need to know to be a Saturday mechanic for your speakers.

BY MARC STERN



Tape Liquid, bonding glue, rubber cement and miscellaneous items like coffee filters, tweezers and scissors are all you need to make the repairs we detail.

**T**here's probably nothing more frustrating to a music lover than turning on the stereo and hearing nothing but shrieks, howls, distortion or, worse, nothing at all. Looking everything over, the system seems okay. But check the speakers; that may be where the fault lies.

Speakers are perhaps thought about less than any other component in the audio picture. You may have the most expensive quad-radial (four-speaker) Super MegaBlast 1000s, but they have to be properly used and cared for. Speakers are really little more than fabric, magnets, wire and a metal frame, despite high-tech sounding names or specifications. Basic speaker construction is one of the few areas of audio which hasn't changed for many years.

Granted, speaker manufacturers are using some new materials and computer-assisted design, but in its basic configuration, the speaker is nothing more than a vibrating cone of material which reproduces sound.

## The inner story

In general, a speaker consists of a metal framework from which the cone is hung. At the center of the cone is a button-shaped item, which is the top of the voice coil. The voice coil is just a powerful magnet surrounded by paper and then covered with a fine coil of wire. This wire is cemented into place with varnish or lacquer. It is the interaction of the coil and magnet which starts the paper cone vibrating.

Of course, new speaker designs usually include three or four speakers in various ranges—the traditional low-range woofer, the high-range tweeter and either one or two mid- or super-range speakers. However, all of these different-range speakers adhere to the same rules.

Quite typically, a set of speakers will have a power-handling rating such as

(Please turn to page 172)

## REPAIRING A RIPPED CONE



**1** First cut a patch to cover the rip. Cut from a material like chiffon or a coffee or vacuum-cleaner filter.



**2** Contour the patch to speaker's shape and saturate the material with rubber cement. Use a cotton applicator.



**3** Hold the rear side of the cone and apply the patch very gently. Rub smooth with even and gentle pressure.



**4** Once glue sets, the speaker should sound about as good as new. Visible patch will be hidden by grille cloth.

## FIXING A SPLIT SEAM



**1** This cone is ripped along the upper seam where it joins the frame. This type of damage may be hard to spot.



**2** A paper clip makes an excellent hook-shaped tool to pull torn edges of the seam flush with the rest of the cone.



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For only \$199.00 you get the COMMODORE VIC-20 Computer plus WE ADD 8,000 BYTES OF USER MEMORY to give you 2% TIMES MORE PROGRAMMING POWER! This powerful full-sized extra featured computer includes the 6502 microprocessor (LIKE APPLE) 20,000 bytes ROM with a 16K extended LEVEL II Microsoft BASIC, 13,000 bytes RAM, a total of 33,000 bytes memory, plug in expandable to 60,000 bytes, 66 key typewriter professional expanded keyboard with graphic symbols on keys, color command keys, high resolution graphics, 512 displayable characters, text display is 22 lines 23 characters, sound and music, real time, upper lower case, full screen editing cursor, floating point decimal and trig functions, string arrays, scrolling, multi statement lines, file management, PEEK AND POKE. Assembly machine language is available. We have easy to use self teaching books and programs. Accepts TAPE-DISK AND PLUG IN CARTRIDGES, connects to any TV, includes AD adaptor, R.F. modulator, switch box, self teaching instruction book, comes in a beautiful console case.

### 41K COMMODORE VIC \$249 WITH FOUR TIMES MORE POWER

For only \$249.00 you get the 41K COMMODORE VIC with 400% MORE PROGRAMMING POWER THAN VIC-20! We add 16,000 bytes user memory to the VIC-20. You get a total of 41,000 bytes memory (20,000 bytes ROM, 21,000 bytes RAM and extended LEVEL II BASIC) plus all the extra features listed!

### 49K COMMODORE VIC \$299 WITH SIX TIMES MORE POWER

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### TRACTOR-FRICTION PRINTER \$399

This all new COM-STAR deluxe line printer, prints 8 1/2" x 11" letter quality full size, single sheet, roll or fan fold computer paper, labels, etc. 40, 66, 80, 132 columns. Impact dot matrix, bi-directional, 80 CPS. Includes special cable that plugs direct into the VIC-20 printer port — no other costly interface is needed! List \$599.00 Sale \$399.00.

### SUPER 10" COM-STAR PRINTER \$499

Has all the features of the COM-STAR printer shown above, PLUS! 10" carriage 100 CPS, Dot addressable bit image graphics, 2.3 buffer, 18 character sets, 40, 48, 66, 80, 96, 132 columns, prints true descender, super and subscript, underlining. Includes special cable to plug in to the VIC-20 printer port. List \$699. Sale \$499.

### 80K MEMORY EXPANDER \$79

Allows memory expansion to 80K total (20K ROM and 40K RAM). Has six slots to add six cartridges — you can switch select any combination of memory or programs. Stop and start any program with reset button, you don't have to remove cartridges or turn off computer. This expander is a must to get the most out of your VIC-20 Computer!

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WOW!! Plug in our new "GAME LOADER" and you can play all ATARI video game cartridges, Activision, Imagic M-Network on your VIC-20 computer. List \$99. Sale \$79.

### LOW COST PLUG IN EXPANSION

Accessories plug in direct to this computer, extra RAM memory, data cassette, telephone modem \$99.00, deluxe 80 column printer \$399.00, 170K disk drive \$349.00 all plug in direct! You do not have to buy an expensive expansion interface!

### WE HAVE THE LOWEST PRICES

We sell direct to customers and you save the profit margin normally made by computer stores, department stores and distributors, we are willing to take a smaller margin to develop volume. WE LOVE OUR CUSTOMERS — OUR PRICES PROVE IT!

### IMMEDIATE REPLACEMENT WARRANTY

If your computer fails because of warranty defect within 90 days from date of purchase, you simply send your computer to us via United Parcel Service prepaid. We will "immediately" send you a replacement computer at no charge via United Parcel Service prepaid. This warranty applies to all products we sell because WE LOVE OUR CUSTOMERS!!

### 15 DAY FREE TRIAL

#### DON'T MISS THIS SALE-ORDER NOW

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\$59. for 6 pack of programs  
Specify pack wanted \_\_\_\_\_
- ☐ 33K-VIC for only \$199.
- ☐ 41K-VIC for only \$249.
- ☐ 49K-VIC for only \$299.
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## GUIDE TO SPEAKER REPAIR

(Continued from page 170)

20 w. RMS or 30 w. RMS listed on it. Essentially, this figure stands for a speaker's average power-handling capability. You can run speakers at or below this figure all day long and not worry about damaging them. Most sound systems are rated for their maximum RMS power output. So if your system puts out 30 w. RMS and your speakers are rated 30 w. RMS, you're in good shape.

Sometimes, though, speakers are rated for their maximum peak power, or the amount of output they can handle for a short time. This figure is about 1.5 times the value of the RMS or safe value. If you run your speakers at this level very long, you'll ruin them.

Therefore, if your speakers are only rated for their maximum peak power-



**3** Apply rubber sealant in a bead to front surface of cone, covering the now-flush edges of the ripped seam.



**4** While applying, and until sealant begins to set, apply slight pressure from back to keep seam edges in line.

handling capability, you'd be well advised to keep the power down.

### 'Cold' cones

According to Tom Grosvenor, owner of Colonial Audio in Wakefield, Mass., one of the East's leading Marantz repair centers, the two key elements in

speaker abuse are overdrive and distortion. Both cause the same type of failure—"frozen" speaker cones.

What happens is this: The speaker is driven to the point where its cone refuses to vibrate any further. At this point, excess heat is generated and

(Please turn to page 174)

## PLUGGING PINHOLES



**1** Damaged material should be brought flush with the cone. Use a paper clip.



**2** Tape Liquid is popular for repair; you could also use a rubberized glue.



**3** Fill in pinhole while applying even, gentle pressure from behind speaker.

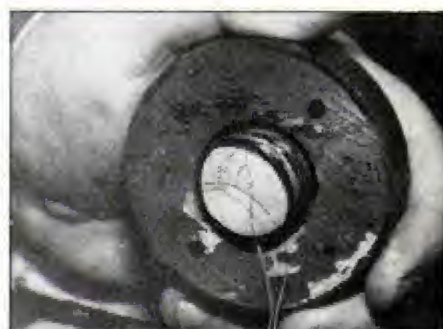
## WHEN ALL ELSE FAILS: REPLACEMENT SPEAKERS



**1** Removing speakers from most cabinets is simple: In this cabinet, each speaker was held by a few screws.



**2** Examine the tweeter: This cone was frozen as varnish oozed from voice coil when the tweeter was overdriven.



**3** Back of same tweeter shows overdriven voice coil. Tweeter must be discarded and a replacement bought.



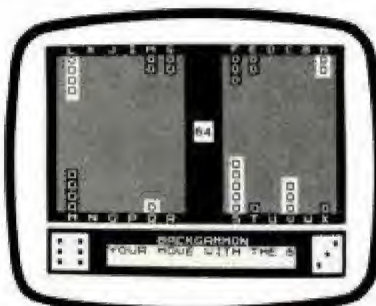
**4** A new, "raw" speaker was used to replace woofers which were victims of overdriving resulting in frozen cones.



**5** When replacing a speaker, look for a mark (usually a red dot) that helps you attach speakers with same polarity.



# Games that challenge you at a price that won't.



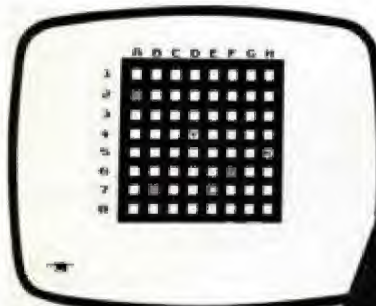
BACKGAMMON



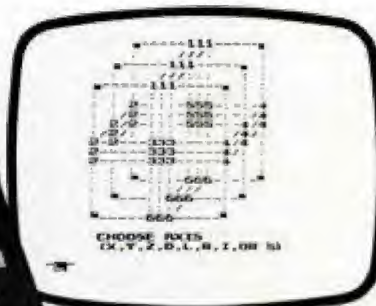
FLIGHT SIMULATOR



CHESS



MIXED GAME BAG



CUBE GAME

Look to Sinclair for the only \$99.95 computer and the first Serious Games Package. A special limited time offer. Call toll free today.

What could be more challenging than creating your own games on a personal computer? Or being intellectually challenged by serious games where you match wits with a computer or another opponent in a fierce trial of skills?

The Timex/Sinclair 1000\* is a fully programmable computer with a powerful BASIC language and complete instruction manual, all for only \$99.95. The moment you sit down with the TS1000 you can learn how to program your own games. Maybe you want to create a stock market game, a word game, a mathematical game. The challenges are endless.

For this one low price, the TS1000 comes with everything you need for connecting the computer to your color or black-and-white TV.

Of course, you might also want pre-programmed software cassettes for your \$99.95 computer. You'll have a wide choice with our free software catalog which comes with the TS1000. And the software cassettes play in any cassette recorder.

## The 16K Memory Module. More power to you.

Let's say you want to go one step further. The 16K Memory Module allows you and your family to be challenged by even more sophisticated games. Not mindless arcade games, but serious, intellectually stimulating games which are both fun and educational.

The Memory Module costs only \$49.95 and plugs onto the back of the TS1000 for 8 times more memory capacity. A whole new world of software is available to those with the 16K Memory Module.

## The Serious Games Package. A \$75 value for only \$50.

For those who want a lot of serious 16K games, Sinclair announces a special software offering with a \$25 savings! Now, for the first time, you can receive all five games shown above at the reduced price of only \$50.

Chess: You can play with another opponent or you can match wits with the computer.

Flight Simulator: Maneuver and land a light aircraft with full cockpit controls, instrumentation and navigational aids. You have to allow for wind velocity and direction, rate of descent and mountainous terrain.

Cube Game: Every bit as mind-baffling as Rubik's Cube.

Backgammon: Everyone's favorite. Again, you can play against another opponent or against the computer. Complete with a doubling cube.

Mixed Game Bag: A series of memory and concentration tests including Memory Magic where you have to repeat sequences on the screen.

There's never been a better value on a serious games package. And to think it all starts on a \$99.95 computer!

## Why order today?

In addition to saving \$25 on software, there are other reasons to buy your TS1000 today. Computers costing hundreds and even thousands of dollars rarely offer you games this serious or challenging.

Another reason to order today is convenience, by toll-free phone. No crowds, no waiting lines, no parking worries. It's never been easier to get started in the world of computers. Or more worthwhile.

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Just call our toll-free number and use your MasterCard or VISA. Or send the coupon with a check or money order. Then try out the Timex/Sinclair 1000 for 10 days at no risk. If you're not entirely satisfied, we will refund your money. It's as easy as that. (Sorry, no refunds on software.)

Call toll-free: 800-543-3000. Ask for operator 509. In Ohio call: 800-582-1364. Ask for operator 509. In Canada call 513-729-4300, operator 509. Have your MasterCard or VISA ready when calling. Phones open 24 hours a day, 7 days a week. These numbers are for orders only.

If you simply want information, please don't call, write Sinclair Research, Ltd., 2 Sinclair Plaza, Nashua, NH 03061.

**Call toll free 800-543-3000**

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One Sinclair Plaza, Nashua, NH 03061

☐ Check or Money Order enclosed

	Price	Qty.	Amount*
TS1000	\$99.95		
16K Memory Module	\$49.95		
16K Cassettes	\$15.00 each		
Special Serious Games Package (5 games valued at \$75.00)	\$50.00		
Shipping/Handling	\$ 4.95		\$ 4.95

\*U.S. Dollars

Total:

Cassettes for 16K Memory Module: \$15.00 each. Check the boxes of all the cassettes you want.

- ☐ Flight Simulator #6 ☐ Mixed Game Bag #26  
☐ Chess #7 ☐ I'll take all 5 cassettes included in Sinclair's Special Serious Games Package.  
☐ Backgammon #8  
☐ Cube Game #9

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\*Sinclair technology is the heart of both the ZX81 and the Timex/Sinclair 1000 computer.

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## GUIDE TO SPEAKER REPAIR

(Continued from page 172)

begins to be dissipated. Since this heat is looking for a good conductor, it heats up the metal frame of the speaker.

This excess heat begins to work on the varnish or lacquer covering the voice coil, which begins to liquefy. About the only place this now-liquid substance can go is to the speaker cones.

Then, when you turn off the stereo and the speakers begin to cool, this varnish begins to harden. If this is repeated often enough, the cones can freeze stiff, resulting either in total distortion or no output at all.

This is what happened to a pair of speakers used in this story. When they were opened for repairs, we discovered that the cones of the woofers and tweeters were frozen. We had to replace both elements, as well as repair the crossover network. (The crossover network carries the right sound to the proper speaker and ensures it is phased correctly.) The excessive heat had destroyed a capacitor.

There are a few ways to prevent this occurrence. The best is never to overdrive the speakers. *If the only indication of their power-handling capability is the maximum peak power they can handle, multiply that figure by .7 and you will have their actual capability.*

Distortion-caused problems occur when worn stereo stylus cartridges cause strange audio frequencies to be generated. These are usually too high for you to hear, but the system hears them, the speakers heat up and the scenario repeats itself.

To prevent this, make sure the cartridge is in good shape and the tone arm isn't causing too much drag.

What happens if the speaker freezes? The only cure for this is replacement. You can buy replacement speakers from the speaker manufacturer. If not, many electronics stores sell "raw" speakers and they'll help you pick a suitable replacement.

### Repair tips

With the trend today toward removing speaker grille cloths for appearance, there are many opportunities for getting tears, rips or holes in your speaker cones. Speakers are fragile and can't take much abuse. But when small accidents occur, they usually can be repaired.

For instance, what happens if one of your speakers develops a rather large rip? The repair for this is easy.

First, remove the speaker carefully from its cabinet. Take a piece of light material, such as a discarded piece of chiffon or a coffee or vacuum-cleaner filter and contour it to the speaker's

shape, making sure it's large enough to cover the rip. When this is done, saturate the piece of shaped material with rubber cement. Then, holding the rear side of the cone gently, apply the patch and smooth it in place. Allow the glue to set and replace the speaker. It should be as good as new. (If the patch isn't the exact color of the speaker itself, you can re-cover the cabinet with grille foam. It is available at audio shops or from stores such as Radio Shack.)

### Pesky pinholes

If you find a pinhole in your speaker cone, place your hand on the rear of the cone and gently push the pinhole outward. This should cause it to fill in. Then, with a liquid vinyl repair chemical, such as Tape Liquid or rubberized glue, cover the pinhole gently. Resmooth the repaired spot from the rear and allow it to set. This should make your speaker as good as new.

### Severed seams

One of the trickiest types of repair involves fixing a rip along the upper seam of the cone where it joins the frame. For this repair, take a small stiff piece of wire, such as a paper clip, and bend an end into a small hook. Use this small tool to fish around gently and pull any part of the tear flush with the rim of the cone. (This method also works with other types of rips.)

Then, take some rubber sealant—available at Radio Shack or your local hardware store—and lay down a bead of it. Keep your finger on the rear of the speaker to assure a proper bond. This should repair the rip. Allow the sealant to set and put the speaker back into its cabinet.

### Split wire ends

Another problem from which a speaker can suffer is a broken or disconnected wire. This repair, too, is easy, but you'll need a soldering iron. Use only rosin-core solder, *never* acid-core.

After soldering, wrap the repaired area with vinyl tape so that it's insulated. You can also use heat-shrink tubing.

If the speaker wire is disconnected from the terminal, merely heat the terminal, causing the old solder on it to flow. Then hold the wire to the terminal until the solder cools and sets.

Be sure that the speaker wire colors match or you run the risk of cross-polarizing the speakers and affecting the sound output. And always be sure the impedances of your system are matched. This means your stereo output should match the figures on the speaker. If a speaker is rated from 4 to 16 ohms and you place a different load on it, all you'll hear is distortion. **FM**

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# PONTIAC 6000LE

Capable, But Needs The V6



Our test Buick LeSabre has already proved itself as a people hauler. We'll let you know how it hauls itself in our next report.

**S**ince our last update (*PM Long-Term Car Tests*, page 60, Jan. '83), we turned in a Pontiac, picked up a Buick and completed our testing of an AMC/Renault Alliance. Here's what's been happening.

### Pontiac 6000LE

When we turned in the car, it had 7,348 miles on the clock, 5,002 of which were accumulated by our staff. Our last impression of the car closely followed our first impression: "Gee, this is a really nice car with excellent handling. Wish it had more power."

Overall, our test car averaged 19.2 mpg over the 5,002 miles—not so great for a four-cylinder automobile. We expected more, since we ordered the four-cylinder engine thinking we'd get better mileage and knowing we'd be sacrificing performance.

Our recommendation is still to order

the V6 engine if you're considering a Pontiac 6000LE. We reported last time that our V6-powered Pontiac 6000 averaged 20.7 mpg over 1,700 miles. That was despite the larger engine, simply because we didn't have to drive the V6 as hard to make it move.

The only glitch that developed with this car since our last report was in the power window system, which conked out twice in the last 1,500 miles. In both instances, the windows were fixed free under warranty at a dealer.—Joe Oldham

### Buick LeSabre

In case you haven't noticed, not only have gas prices stabilized recently, but they're actually going down in some areas of the country. Whether this situation is permanent or long term, no one knows. However, the American car-buying public has reacted predictably.

We're buying big cars once again.

Let's face it. Americans love a big, roomy car. There's no substitute for cubic feet of interior room. So, despite all the doomsday predictions about how the world will end—or at least run dry of oil—we're buying big cars.

The result is that Cadillac has had to put on an additional shift at the home plant which makes the DeVille series; Buick's LeSabre and Electra sales are up about 10.9 percent; Chevrolet is selling more Impalas and Caprices than some of their smaller cars; and Chrysler can't make enough New Yorkers to fill the demand.

What's going on here? Lee Iacocca is going crazy because Chrysler has just spent billions outfitting production plants to make small cars, and big car sales take off again. What's going on is that the American predilection for large

(Please turn to page 178)



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## LONG-TERM CAR TESTS

(Continued from page 176)

cars has not diminished, all the Arab sheiks notwithstanding. So big-car sales are up. Everything else is down.

We thought it would be a good idea to examine a traditional all-American sedan—a big one—to see if it still has the appeal of the old days for us, as it seems to have for many of today's car buyers. Your letters, too, indicated that you wanted us to write more about larger American cars.

So we asked Buick to loan us a LeSabre four-door sedan. The LeSabre is part of General Motors' B-body fami-



Room, room and more room: That's the big appeal of the traditional full-size car.

ly of cars. Other members include the Chevrolet Impala/Caprice and the Oldsmobile 88 (and used to include the Pontiac Catalina/Bonneville when they still made them).

A few years ago, the LeSabre would have been considered a large car, but not the largest. After all, Buick makes an Electra that is even larger. Today, despite the larger cars like the Electra, Olds 98 and Cadillac deVilles, the LeSabre looks enormous. Our perspective has changed because there are so many small cars on the road these days.

Compared to just about anything, the LeSabre is enormous. Its wheelbase is 115.9 inches, and the car measures 218.4 inches overall with a curb weight of 3,700 pounds. And remember, these cars were downsized in 1977.

All this size translates into interior room and lots of it. The huge front seat offers passengers 42.2 inches of legroom. Rear-seat passengers can stretch out in 38.9 inches of legroom. And headroom is a spacious 39.5 inches.

All this translates into enough space to carry six passengers, *real* passen-

gers, not kids, in comfort. Climbing into the interior of this car brings back memories of the good old days when a car was wide enough to carry six people without the middle guys feeling like they were in a sausage maker. And rear-seat passengers have enough legroom to sit like ladies and gentlemen. This is in contrast to what usually passes today for rear-seat legroom. In some cars we've tested recently, only a package of groceries could feel comfortable in the back seat.

The interior in our test car was even more luxurious than we wanted it to be. We ordered the car with the standard LeSabre vinyl interior with a notchback seat. What we got was a LeSabre Custom with the optional velour 45/55 seating and power assist. (We accepted the car, but we're going to find out why it wasn't delivered as we wished.) We like the 45/55 seating a lot. It allows you to get comfortable behind the wheel without disturbing your passengers. The electrically adjustable seat option and tilt wheel help here, too. However, we're not big fans of velour upholstery. It attracts every piece of lint in the universe and is so sticky you can't slide into a comfortable position on it. We'll see how it cleans up when the kids—or we—spill something on it.

The drive train on our test car is the most powerful Buick offers these days in this series. The 307-cu.-in. four-barrel V8 under the hood is rated 140 hp at 3,600 rpm. The car's 3,700 pounds is quite a bit of bulk to be moved around by 140 horses. But the 307 acquits itself nicely. It doesn't feel sluggish, although it turns out to be pretty slow when clocked. We've managed 0-to-60 times of 14.3 seconds, but the engine isn't broken in yet, so we expect this to improve.

We had ordered a 3.23 final drive ratio to make the car quicker, but the car came through with the standard 2.73 ratio instead. Similarly, we ordered the low-profile P225/70R15 tires available for LeSabres to maximize the car's handling. Instead, we received skinnier P215/75R15 radials. These taller tires produce better mpg numbers, albeit at a sacrifice in handling.

One thing we did order and get is the Gran Touring suspension option. This is a \$49 item that we wouldn't be without. The ride is still soft and cushioned, but there's a measure of control there that's missing on larger cars with standard suspensions. The option consists of higher rate springs, shocks and stabilizer bars and the addition of a rear stabilizer bar plus power steering.

In our next report, we'll have a complete rundown on the performance, handling and fuel mileage of this new addition to our test fleet. Meanwhile, we'll enjoy the room.—Joe Oldham

## AMC/Renault Alliance

After 4,000 miles and a zillion thumps on the treacherous West Side Highway, our long-term Alliance DL is ready to go back to its owners in Kenosha, Wis. AMC/Renault will get back its car still ticking with the precision of an atomic clock. A car in its first year of production, no matter what part of the world it's built in, usually needs another year of development before all the bugs are worked out. The Alliance seems to be one of those cars that has come complete and ready to go, right out of the box. Nothing seems to have been overlooked, either in the design stage, tooling or assembly. Everything just flat works.

We're not given to unqualified praise around these parts, usually because there's a lot to be critical about. But even the most demanding driver would have a hard time finding anything bad to say about the Alliance.

On the highway, at slightly higher than legal speed limits, the Alliance burns fuel at the rate of 32 mpg. In the city that number only goes down to 25 mpg, which is remarkable. On the coldest of mornings with a wind chill hovering around 0° F., the engine fires up first shot, thanks to the throttle body fuel-injection system. Cold drive-off is excellent, with no stuttering, lurching or stalling. California drivers will have even less trouble because they get multipoint port injection on their cars.

## Clever oil gauge

One feature that's particularly clever and appreciated is the oil-level indicator gauge. It only activates when you start the car. During the start cycle, a needle swings across a horizontal gauge to tell you how much oil is in the pan. After the engine fires, the needle disappears.

The System Sentry and Infrared Entry options weren't available when we took delivery of the car, but lucky prospective owners can now order them. After seeing those options work on other Alliances, I'd recommend them enthusiastically. For more details of those options, see *Saturday Mechanic Looks At The '83 AMC Cars*, (page 170, Oct. '82).

The only mechanical problem of any sort on our test car was a sticky left rear door lock. A 15-minute visit to the local dealer got it fixed under warranty and we haven't needed to visit him again.

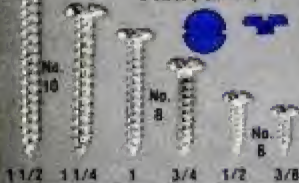
If we were the kind of magazine that handed out Best Car of the Year awards, the Alliance would be it. In the highly competitive market segment which had been dominated by Japanese economy cars, the Alliance has risen to the top and simply blown the competition away.—Tony Assenza



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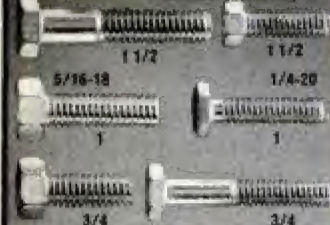
### SHEET METAL SCREWS 6 Sizes (Panhead)



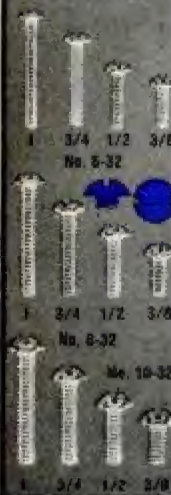
### WOOD SCREWS 6 Sizes (Flathead)



### MACHINE BOLTS 2 Diameters, 3 Lengths of Each Diameter (Hex Head)



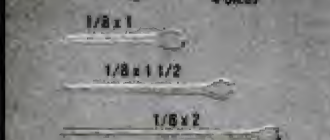
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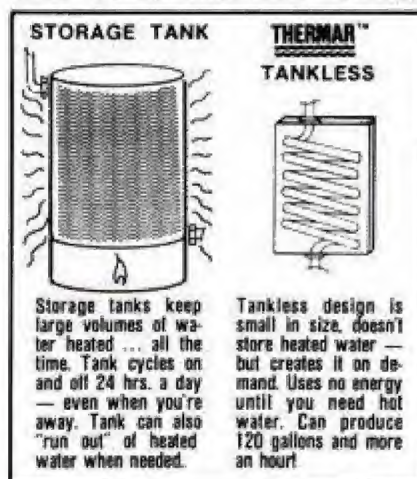
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PM0383

## BIKE THAT ATE NEW YORK

(Continued from page 166)

ried commuter can learn to love, is one of them.

The mountain bike, like so much of our well-intentioned high-tech inventory, came out of California. One critic has called it the perfect blend of European precision, lightweight bicycle and American newsboy's old reliable. I can't argue with that. I have not ridden a wide variety of off-road bikes (as was the original premise for the format), but the Stumpjumper, which is assembled by Specialized Bicycle Components (844 Jury Ct., San Jose, Calif. 95112), appears to be the class of the breed.

Mind you, the company has no qualms about pricing this bicycle at over \$800 (although a \$500 version with economy components is now available). One of the reasons for the high price tag is its light weight. Even with the 26-inch balloon tires and "bomb-proof" custom wheels, plus motorcycle-type brake (Tomaselli levers), the Stumpjumper is less than 30 pounds.

### Commuter's nightmare

Urban commuting is a special challenge for a biker. When you're being chased over sewer grates, in and out of potholes and up and over curbs by the mechanized rodeo we call rush hour, you need a light armored vehicle. Yet the main reason you're riding a bike in the first place is to beat the system—high mass-transit fares, crowds, delays, inconvenience—and that calls for a fair turn of speed.

Recently, I rode a borrowed Motobecane ProLight bicycle (a European road-racing format) from my home in New Jersey to mid-Manhattan. The 16-mile trek took about an hour and 10 minutes, which is not bad when circuitous routing, unforeseen obstacles and inevitable traffic jams are factored in. On the Stumpjumper, I cut 15 minutes off that.

The point is that, while my personal format (at more than 225 pounds) is not that of a *Giro d'Italia* champion, the "fat-tire flyer" was a much better match for the urban/suburban route's terrain than any superlight, skinny-tired speed machine could be.

There are both street-version and off-road tires available. I used only the off-road type shown in the PM photos. They tend to "sing" as you get up to smooth pavement speeds, which indicates they're holding you back. Besides the tires, the raked fork's geometry is what makes the bike resilient enough to take on the worst surprises a metropolitan streetscape—the Big Apple leads the world in this event—can spring on you. And in lowest gear on your 15-speed, triple-crankset transmission, you can almost climb buildings. **PM**





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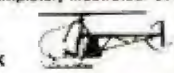
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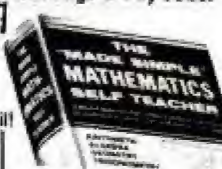
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**DADO HEADS**

standard dado set arrangements

SET NO.	MAXIMUM WIDTH OF GROOVE	NUMBER OF OUTSIDE TEETH	NUMBER OF INSIDE CUTTERS	
			1/2"	3/4"
1	1/2"	2	1	1
2	3/4"	2	1	1
3	1"	2	1	1
4	1 1/4"	2	1	1
5	1 1/2"	2	1	1
6	1 3/4"	2	1	1
7	2"	2	1	1
8	2 1/4"	2	1	1
9	2 1/2"	2	1	1
10	2 3/4"	2	1	1
11	3"	2	1	1
12	3 1/4"	2	1	1
13	3 1/2"	2	1	1
14	3 3/4"	2	1	1
15	4"	2	1	1
16	4 1/4"	2	1	1
17	4 1/2"	2	1	1
18	4 3/4"	2	1	1
19	5"	2	1	1
20	5 1/4"	2	1	1
21	5 1/2"	2	1	1
22	5 3/4"	2	1	1
23	6"	2	1	1
24	6 1/4"	2	1	1
25	6 1/2"	2	1	1
26	6 3/4"	2	1	1
27	7"	2	1	1
28	7 1/4"	2	1	1
29	7 1/2"	2	1	1
30	7 3/4"	2	1	1
31	8"	2	1	1
32	8 1/4"	2	1	1
33	8 1/2"	2	1	1
34	8 3/4"	2	1	1
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37	9 1/2"	2	1	1
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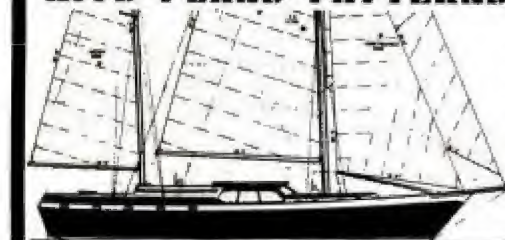
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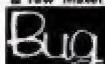
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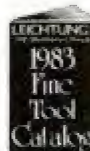
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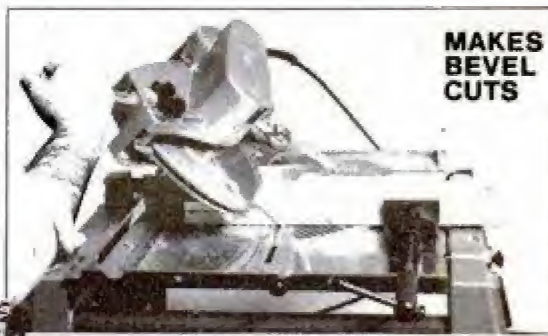
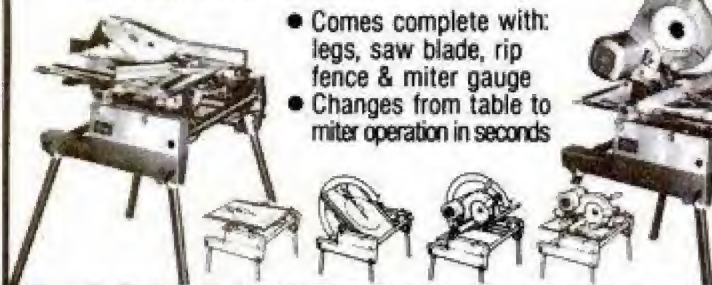
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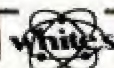
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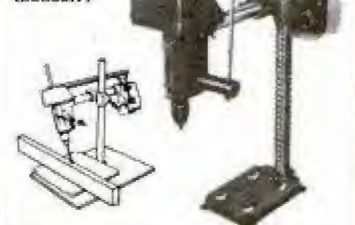
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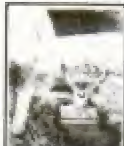
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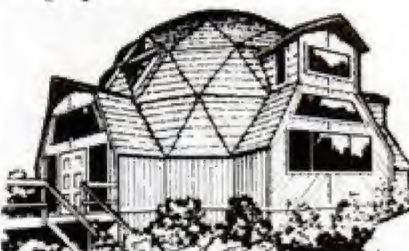
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22	24.2	25.5	28.6
23	25.3	26.7	29.9
24	26.4	27.8	31.2
25	27.5	29.0	32.5
26	28.6	30.2	33.8
27	29.7	31.3	35.1
28	30.8	32.5	36.4
29	31.9	33.6	37.7
30	33.0	34.8	39.0
31	34.1	36.0	40.3
32	35.2	37.1	41.6
33	36.3	38.3	42.9
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NEW YORK—One million of the world's slimmest, famous "micro-chip" quartz calculator/watches will be sold as part of a publicity campaign for only \$15 apiece to the first one million persons who apply in writing to the company before Midnight, May 31, 1983.

These are the same nationally publicized LCD Quartz "micro-chip" calculator/watches to be featured in *The New York Times*, *Cosmopolitan*, *Playboy* and other leading publications. The slimmest calculator/watches in the world, they are so powerful they never need winding, and accurate to within seconds per month.

The digital display shows year, month, date and day of the week (as well as hour, minute and second) in full quartz digital mode. A built-in "melody" alarm wakes you in the morning, reminds you of appointments during the day, and even tells you when it's time to put another coin in the parking meter. (It also chimes on the hour.)

The calculator is accurate to 8 places, features a sophisticated 16-pad keyboard with full computer memory, and performs all standard operations such as addition,



subtraction, multiplication, division, percentages, square roots, etc. It will even balance your checkbook and prepare your Income Tax Return.

These famous LCD quartz calculator/watches will not be sold at this price by the company in any store. To obtain one at this price, apply in writing to the com-

pany address (below) before Midnight, May 31, 1983.

Each calculator/watch carries a full one-year money-back guarantee and will be replaced by the company, free of charge, if it ever fails to function.

There is a limit of two (2) watches per address at this price, but requests which are mailed early enough (before May 25) are permitted to order up to 5 watches.

To apply for an LCD quartz calculator/watch, mail your name and address *and this original printed notice* together with \$15 for each watch desired. Add only \$2 shipping and handling no matter how many watches you are requesting. Mail to:  
**Carter & Van Peel, Ltd., Calculator/  
Watch, Dept. 114-5, Box 1230,  
Westbury, New York 11595.**

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(V21220)





## Mazda B2000 Sundowner. Today's lowest-priced truck is also today's best truck value.

1983 Mazda B2000 Sundowner **\$5795\***

It's not hard to find a low-priced truck these days. The trouble is, most of them don't have the features you're looking for.

On the other hand, consider the Mazda B2000 Sundowner—the lowest-priced truck in America. Its price alone makes it worth looking at. But when you also realize how well-equipped it is, it's almost irresistible.

For example, the B2000 is priced below Toyota's and Datsun's economy trucks. Yet it comes with many standard features they don't even offer.

These features include 5-speed overdrive, steel-belted radials, full carpeting, tinted glass, trip odometer, intermittent windshield wipers, swing-out side vent windows, dual



*Standard features include 5-speed overdrive and steel-belted radials. Neither is available on Toyota's or Datsun's economy truck.*



*Handsomely appointed interior includes full carpeting and three-passenger seat detailed in textured vinyl.*

door armrests, and more.

The B2000 also has wider wheels, a longer bed, a larger gas tank, and gets better fuel economy.

Further—**38** EST. HWY. MPG **27** EST. MPG more, the B2000 is built to haul a heavy payload of 1400 pounds. Its body and frame are strong, and so is its 2-litre overhead cam engine.

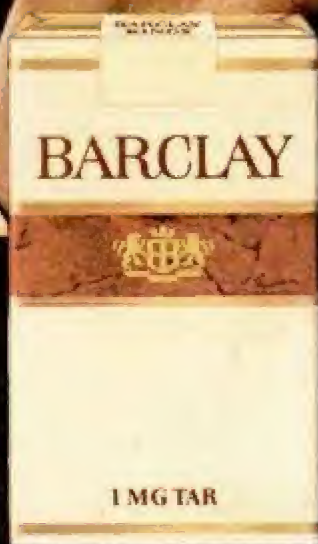
If you're looking for an economy pickup, you'll appreciate the astonishing value of the Mazda B2000 Sundowner. With its long list of standard features and superb gas mileage, today's lowest-priced truck is more than inexpensive. Much more.

# **mazda**

The more you look,  
the more you like.

\*Manufacturer's suggested retail price for B2000 Shortbed. Actual price set by dealer. Taxes, license, freight, options and other dealer charges extra. Price may change without notice. Comparisons based on '82 information. For '83 they may vary, as may availability of vehicles with specific features. \*\*EPA estimates for comparison. Your mileage may vary with trip length, speed and weather. Highway mileage will probably be less. Calif. 36 Est. hwy. mpg, 26 Est. mpg.





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Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.